The Dock & Harbour Authority

No. 438. Vol. XXXVII. APRIL, 1957 Monthly 2s. 6d.

New Ipswich Dredger works between Berthed Ships

Efficiency of Priestman Grab-Hopper Proved

The Ipswich Dock Commission have recently taken delivery of the 370-tons capacity Diesel-driven Grab Hopper Dredger Samuel Armstrong.

This vessel was built by Henry Robb Ltd., Leith, in accordance with the requirements of Lloyds Register of Shipping and the Ministry of Transport and Priestman Brothers Limited were the Consultants.

The principal dimensions are:

Length between perpendiculars ...	...128′ 6″	Hopper capacity, tons ...	370
Breadth moulded ...	28′ 6″	Oil fuel capacity, tons ...	20
Breadth overall ...	30′ 3″	Engine b.h.p.	700
Depth moulded ...	12′ 0″	Engine r.p.m.	350
Loaded draft, mean ...	10′ 6″	Speed on trials, knots ...	10.5

This vessel is of the single-deck type and the hull is sub-divided by watertight bulkheads.

Approximately amidships is located the steel all-welded hopper with its ten steel, wood-lined, doors hinged on the hopper sides. The doors are raised in pairs by means of an electric winch with extended warping ends and are held in the raised position by means of large steel cotters which are knocked out to lower the doors.

An additional feature which is fitted to the Priestman crane is a special lifting attachment for salvage work whereby the crane is able to lift loads up to 20 tons over the stem.

The dredging crane, which is diesel driven, is of the Priestman No. 50 size and operates either a 70 cu. ft. Mud or a 55/44 cu. ft. Heavyplate Grab in sand or similar materials. On trials, 410 tons of spoil were loaded into the hopper in 78 minutes, the crane making 118 operations in this time in a depth of water of 30-ft.

The dredger is propelled by a Crossley 8-cylinder two-stroke marine oil engine running at 350 r.p.m. and on trials a loaded speed of 10.5 knots was attained.

All the accommodation is aft on the main and boat decks and consists of two single-berth cabins for the Master and Chief Engineer and three two-berth cabins for the crew. The total working crew consists of five men.

The vessel in service does one round trip per day and has to travel 14 miles to the open sea off Harwich to dump the spoil.

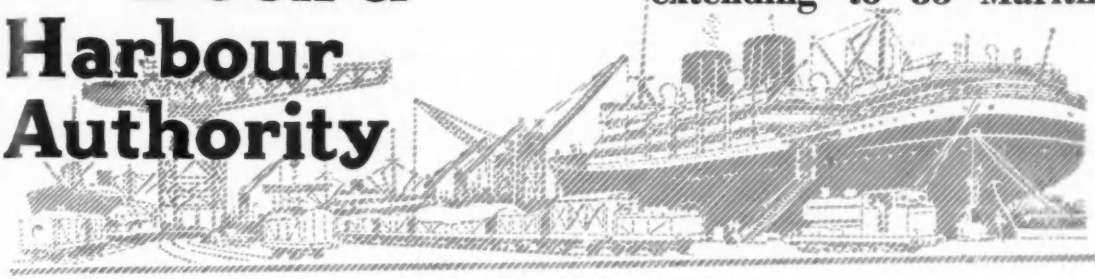
All the deck machinery is electrically operated at 110 volts D.C., the power being supplied by two Dorman-engined auxiliary generators situated in the engine room, one of these sets being a stand-by.

The vessel is named after the present Chairman of the Dock Commission and the photograph shows her working at Cliff Quay, Ipswich.

Prior to the purchase of this new dredger the dredging in the dock and along the quays was done by an old steam dredger which was unable to cope with the work with the result that contracts had to be made from time to time. The Samuel Armstrong will be able to do all this work and, by virtue of her handiness, she will be able to dredge in confined spaces between ships laid at the berths.

The Dock & Harbour Authority

An International Journal with a circulation extending to 85 Maritime Countries



No. 438

Vol. XXXVII

APRIL, 1957

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Editorial Comments

The Port of Liverpool.

The leading article for this month, for which we are indebted to Mr. F. H. Cave who until quite recently was the general manager of the Mersey Docks and Harbour Board, gives a comprehensive and detailed account of the important reconstruction and improvement works which have been carried out at the Port of Liverpool during the post-war period.

This Journal has already published in previous issues a number of articles describing the many problems which faced the port at the conclusion of hostilities. As the result of devastating air raids, the damage inflicted on the docks and port installations was enormous and the cost of reparation and reinstatement works now runs into millions of pounds. In addition many of the improvements have involved a number of unusual constructional problems which are of particular interest to the dock engineer. As is stated by our Contributor, these problems were successfully overcome, despite the handicaps imposed by the shortages of materials and skilled labour.

It is interesting to note that the Mersey Docks and Harbour Board is nearing its Centenary, as it was on 1st January 1858 that the Board became the Statutory Authority and assumed the responsibility of management. The enterprise and initiative that has been maintained during the past hundred years is shown by the fact that Liverpool now ranks as the second general cargo port in the United Kingdom.

Proposed Development of Port of Eilat.

Early this month the first tanker ever to carry oil to Israel through the Gulf of Akaba reached the port of Eilat, situated at the head of the Gulf. Its cargo of crude oil was piped into the new storage tanks which have recently been erected at the port, and from these the oil will be piped northwards to Beersheba. It is now reported that plans are under consideration for Israel to establish a tanker fleet of six ships to operate a regular service to the newly opened port.

Since the Arab blockade of the Straits of Tiran was lifted by the Israeli action in Sinai last year, thirteen ships have used the port of Eilat and 20,000 tons of merchandise have been handled. Now, despite the continuing uncertainty with regard to the final management of the Suez Canal and freedom of entry into the Gulf of Akaba, the Israeli Government has decided to spend a sum of £25 million on extending the dock area and port facilities. It is hoped that eventually the port will be able to handle up to 1,500,000 tons of cargo a year.

Plans for the port development include four deepwater berths, an oil terminal and increased shipping facilities. This would mean that Eilat would serve as the port linking Israeli industries with the raw materials of Africa and Asia. Phosphates, potash and salt would be exported, and imports would include oil seeds from East and South Africa, maize and fodder mainly from South Africa, copra from India and the Philippines, as well as sulphur, cocoa, coffee, rubber, hides and timber from these and other countries. A key feature of the importance of the port, however, would be its use as an oil terminal.

In view of the deadlock in the negotiations between Mr. Dag Hammarskjold and President Nasser over the future management and use of the Suez Canal, with which no doubt will be included the control over the Straits of Tiran, it is likely to be some considerable time before the Israeli Government can hope to be given international assurance that entry to Eilat will not be impeded in the future. Without this guarantee, any expansion of the port might well become a wasted expenditure and it is therefore to be sincerely hoped that the Conference soon to be held in Geneva on the Suez Canal will this time achieve definite results.

Remedial Measures at Pyrmont, Port of Sydney.

An interesting problem confronted the authorities at the Port of Sydney in the choice of suitable remedial measures to overcome the serious settlement which has been taking place over a number of years at their Berth No. 21, North. We are indebted to Messrs. Griffin and Wallace for a very complete description of the procedure adopted, details of which were published in the May, 1956, issue of The Journal of the Institution of Engineers, Australia. We are pleased to be able to present a shortened form of the paper in this issue. The subject matter includes a description of certain specialised equipment which we believe will be of general interest and which has received favourable reports by the New South Wales Maritime Services Board.

Budget Aid for British Shipping.

The announcement made in his Budget speech last week by Mr. Peter Thorneycroft, the Chancellor of the Exchequer, that he had decided to increase the investment allowance for expenditure on new ships from 20 per cent. to 40 per cent. has been warmly welcomed by all those connected with the industry. This is a substantial move towards putting British shipowners in a competitive position with the lower-taxed foreign owners, especially with those virtually tax-free companies that operate under flags of convenience.

Strong representations have repeatedly been made to the Chancellor in the case of the shipping industry, which is indeed in a special position, and Mr. Thorneycroft's recognition of the efficacy of the arguments is a further indication of the Government's awareness of the many difficulties facing shipowners today.

The increase in the investment allowance will now encourage the industry to make a beginning towards solving the financial problems associated with tonnage replacement. However, much time has been lost and it will be several years before the industry can be said to have reached equal competitive status with overseas companies. Moreover, another barrier, that of the present unsatisfactory Union/Employer relationship in the shipbuilding and engineering industries must be overcome before much benefit can be derived from the concession now granted to shipowners. The plain fact is that the investment allowance lays no obligation on the owner to place his orders with shipbuilders in this country, and he may be forced to place his orders elsewhere if the restrictive practices and the uncertain labour conditions are not radically changed.

Speeding Cargo Clearance at Port of Liverpool.

The annual report of the Liverpool Steam Ship Owners' Association ranges over a wide variety of subjects. Most of them were dealt with in the report of the Chamber of Shipping referred to last month, but there is naturally a difference of emphasis—the Association represents only liner interests—and there is discussion in some detail of the conditions in the port of Liverpool and the campaign which the Association has been conducting to relieve

Editorial Comments—continued

congestion and facilitate the speedier turn-round of ships. Fuller reference to this is made elsewhere in this issue. On the general outlook, it is pointed out that with exports as a whole exceeding both in weight and value any figure previously attained in the past, the record of the year would have been one for considerable satisfaction were it not for the happenings over the Suez Canal towards the end of it.

The account given of the steps taken by the Association to speed up the clearance of import cargoes from the quays is of great interest. A special committee was appointed in 1955 to investigate this matter and it came to the conclusion that the over-riding factor in the congestion from which the port had been suffering was failure to clear goods "timeously" and the misuse of quay space as temporary warehousing accommodation. This is a practice which has grown up in many ports, but in Liverpool it seems to have assumed abnormal proportions. The remedy suggested is "penalty rents" and compulsory warehousing, with removal into warehouses of goods, where necessary, at the expense of the owners. This is the dockside equivalent of the parking problem, with the police having authority to remove bodily cars which hold up road traffic. The Mersey Docks and Harbour Board have the necessary powers and the Association says that it looks to the Board to exercise those powers whenever occasion demands.

Cost of Suez Canal Clearance.

Also contained in the Report of the Liverpool Steam Ship Owners Association is a forthright comment concerning the suggestion that the cost of clearing obstructions from the Suez Canal should be paid by the Canal users.

Pointing out that at the time of the conflict between Israel and Egypt and the Anglo-French intervention the Canal was blocked by sunken craft along its whole course, the report says, "it is important to remember that this was entirely the work of the Egyptians. They might claim some justification for blocking the entrance to Port Said, but, in fact, without purpose or value to themselves or anyone else, they sank everything afloat, blew up two bridges and incidentally bottled up a dozen ships in transit. Much of the material thus destroyed belonged to the Suez Canal Company and is needed for the operation and management of the Canal, which, even when cleared, will not be able to handle its accustomed traffic until this material is replaced. How all this is to be paid for is one of many unknown quantities at the time of writing; but, having regard to the circumstances in which the damage was done, the suggestion that the cost shall come out of the dues payable by the Canal users lacks, in the Association's view, all sense of propriety and justice. There can be no valid ground for imposing this liability on the ships which use the Canal and on the cargoes which are carried in those ships.

"It is not the concern of this report to enter into the political aspects of these troubles. From their outbreak the Association let it be known to H.M. Government that it would support whatever action the government thought necessary to protect the national well-being. It now remains to be seen how far the faith which the government ultimately decided to place in U.N.O. is justified by the event. It has been shown that putting the Suez Canal out of commission has an immediate detrimental effect on the economy of many countries. These countries are not confined to Europe: India, for example, has as vital an interest in the right of unimpeded passage through the Canal as ourselves and the other countries of Western Europe.

"The need now for all of them is that the Canal shall be reopened and kept open with a certainty of the continuance in future, whatever form it may take, of the good and economic management that has characterised its past and, above all, with a guarantee of freedom from political interference of a nationalistic kind. It would be unbearable to international trade and shipping if it were never certain from one month to the next whether discrimination would suddenly be practised against one flag or another, or whether there would be interference for political reasons with ships or cargoes."

No doubt these views will find wide acceptance.

Topical Notes

New Use for Redundant Dock at Newcastle.

In connection with a scheme to establish an oil distribution centre at the Port of Newcastle, a Bill is being promoted in Parliament by the Tyne Improvement Commission. It is seeking powers to fill in the Northumberland Dock with the exception of a small area which will be used to provide an entrance channel and turning basin for barge traffic to and from an adjacent factory. New river walls will be built to seal off the existing dock entrance, to provide the entrance channel and turning basin and also to provide for a deep water berth for tankers which will use the oil centre. Several hundred yards of the existing dock wall will be demolished.

Northumberland Dock, completed in 1857, as one of the first major development schemes of the then newly-constituted Commission, flourished for decades as a coal shipping centre, but it has been redundant for about two years. In November last year, the Esso interests announced that they were acquiring a 60-acre site by the dock for the construction of an oil-distributing centre by 1959, and that berthage would be required by tankers of at least 26,000 tons d.w. No opposition is expected to the Bill, and it is hoped that it will be approved before Parliament begins the summer recess in July.

Modernisation of the Port of Belfast.

Early this month, the Belfast Harbour Board authorised the expenditure of over £650,000 for the construction of three new berths for British Railways on the west side of the Herdman Channel. It is expected that the work will be started shortly and will take from two to three years to complete.

This will be third scheme in connection with the Board's modernisation programme, which is estimated to cost a total of over £2,500,000. The other main items on the programme are the construction of a new quay in Victoria Channel, and a new deep-water wharf in the Herdman Channel opposite the proposed British Railways berths.

The new berth in the Victoria Channel, upon which work is progressing satisfactorily, is designed primarily for the shipment of turbines from the British Thompson-Houston Co. Ltd. factory at Larne to ports in Africa, India, Australia, New Zealand, Canada and elsewhere. It is probable that the wharf, which will be equipped with a 200-ton crane, will also be used by vessels other than those shipping for B.T.H. Ltd.

Work on the wharf in the Herdman Channel is almost completed, and the wharf is expected to be in use by the Autumn. Storage facilities will not be immediately available however, as the shed, 1,100-ft. in length, together with railway lines and crane track, will not be ready until early next year.

These additional berths will substantially increase the port's accommodation for deep-sea vessels.

New Deep Water Berths at Lobito.

Two new deep water berths for ocean-going shipping at the port of Lobito, Portuguese West Africa, were recently opened by the Governor-General of Angola. This latest port development gives an extension of over 800-ft. in length to the South Quay which has also been equipped with four additional cranes, including one of 10 tons.

In 1950 the Portuguese Government enlisted a firm of Swedish engineers to advise them on the long-term development of the port. As a result an additional quay for coastal vessels was completed in 1955, and more recently, silos for the bulk handling of grain have also been provided. The two new deep sea berths increase the accommodation available at the main quays to eight ocean-going vessels. Depths alongside the deep water quays are 32/35-ft. One of the two new berths is connected with a bulk fuel storage depot which was brought into use last February.

Future plans in the port development programme include a mechanised mineral quay with a daily load capacity of 5,000 to 6,000 tons. This is at present under construction and is due for completion in December 1959.

Post War Developments at Liverpool

Review of Extensive Improvements Effected

By FRANCIS H. CAVE, former General Manager and Secretary, Mersey Docks and Harbour Board.

I MAY perhaps be forgiven if I repeat, as an introduction to this article, the following extract from my Presidential Address to the Institute of Transport in October last.

"I think it is axiomatic that no port with a long history of service to the nation can have an absolutely efficient lay-out. The development of ships, cargoes and handling methods during the past hundred years has been too rapid. To this extent Continental ports which were wiped out during the war are now in a very enviable position. Several of our ports received heavy damage during the war but none was so obliterated that it was necessary to redesign it from scratch. . . .

"Nobody knows better than I the frustration which we all experienced in reconstructing our ports. We suffered with the rest of industry through shortages of materials of all kinds, shortages of skilled labour and all the other restrictions (some of which are still with us) of that dreadful post-war period. In addition, the rush of post-war trade, especially exports which occupy port accommodation half as long again as imports, necessitated a spread over in our reconstruction and we are still carrying on for the time being with a certain amount of damaged accommodation. . . . We cannot, however, claim to have reached the full requirements for ships or goods."

The Port of Liverpool, as is well known, is owned and controlled by the Mersey Docks & Harbour Board. Nearly 100 years ago, on January 1st, 1858, this Board, which had been established by Act of Parliament in the preceding year, took over the rapidly growing port from the Dock Trustees of the Liverpool Corporation and became the Statutory Authority for its ownership, management and development. The range of this control was widely drawn for the Board not only own the docks themselves but are the Pilotage Authority for the District which extends to the North West corner of Anglesey, and the Authority responsible for all conservancy work such as lighting, buoyage, dredging and salvage, etc.

Let us first look at the problem we have to face. It is nothing less than to provide accommodation and facilities for shipping which last year aggregated over 36 million tons in and out and for the loading and discharging of over 16 million tons of cargo over the dock quays.

The dock estate covers an area of 2,037 acres with a water area of 638 acres and a lineal quayage of 36 miles. There are in addition to the wet docks and their transit sheds, 19 graving docks, extensive warehouses, 141 miles of dock railways and many other ancillary services.

By the end of the war these docks had suffered the loss through aerial destruction, of no less than 91 acres of cargo accommodation in transit sheds and warehouses completely destroyed and another 90 acres by serious damage, leaving just over 100 acres of accommodation either untouched or with minor damage. In addition immense loss and damage was caused to cranes and other cargo handling appliances.

The problem of the replacement had been under review since the air raids ended in 1941 so that by 1945 a reconstruction programme of priorities and timing had been agreed upon. What had not been foreseen were the acute shortages of skilled labour and materials which were to retard seriously all building work at that time. Bricks were practically unobtainable and reinforced concrete was out of the question owing to the impossibility of obtaining round section steel reinforcing bars. Work was however commenced in November, 1946, although these material shortages necessitated two sheds, planned to be double storey, being redesigned as single storey.

At the outset it was decided that as Liverpool is a general cargo port whose imports (excluding bulk oil and livestock) are half as much again by weight than exports and where far more traffic is transported by road than by rail or barge, so passing through the transit shed, the ideal shed should have a quay margin of about 35-ft., a width of not less than 120-ft., and ample headroom to enable full use to be made of mechanical equipment. It should have on the quayside two lines of rails and be equipped with three and five ton cranes. At the rear there should be two more lines of rails and a wide roadway to give vehicles direct access into the shed. It was also decided to provide, wherever possible double storey sheds at discharging berths and single storey at loading berths.

Unfortunately geographical considerations prevented the achievement of this standard at some of the berths. For example, the first new post-war shed to be brought into commission was built at the West side of the Alexandra Dock. This shed is 1,600-ft. long (1,000-ft. double storey and 600 single storey) but the overall width of the site available, i.e. from the quay edge to the river wall was at one point only 191-ft. In order to leave a rail track and roadway, a minimum of 60-ft. 6-in. wide, the width of the shed had to be reduced to 110-ft. and the quay margin to 20-ft. 6-in. Owing to the sharp turn to the bridge over the passages at the north and south ends of the shed it was not possible to provide railway lines on the quay side but the shed was equipped with 8 three-ton and 7 five-ton semi-portal quay cranes and 12 one-ton semi-portal travelling transporters on the roadside of the double storey portion.

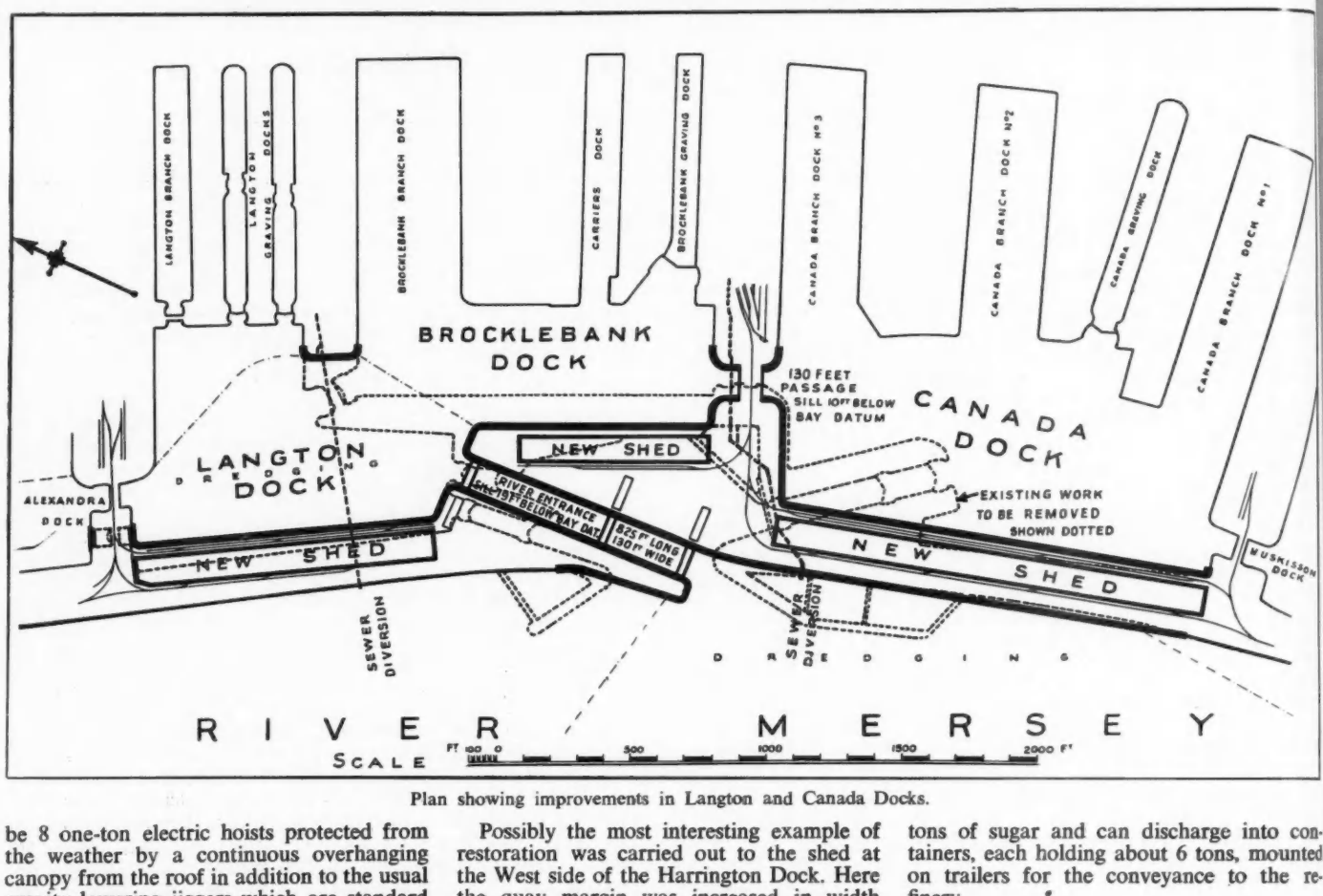
Another example of the way in which restricted space can be utilised to the best advantage is shown by the new shed, 1,050-ft. long, at the North side, Canada Branch Dock No. 1. Here the site is backed by a Graving Dock and in order to obtain a shed width of 120-ft. the quay margin was restricted to 12-ft. and 10 three-ton cranes provided on the roof.

Where space is available, however, a shed can be provided which will more fully meet the operational requirements of Shipowner, Stevedore and Master Porter. An example of this is at the North side, Alexandra Branch Dock No. 3 which is 1,379-ft. long, 125-ft. wide and has a quay margin of 31-ft. It is equipped with 12 three-ton portal cranes on the quay itself. An interesting feature of this shed is that provision has been made inside the shed for the installation in the future of overhead cranes travelling lengthways on rails carried on beams supported by the shed columns. This type of crane proposed is rather uncommon, having a fixed beam, with cantilevered ends, suspended at two points from carriages which travel the lower boom of the crane girder, by which arrangement the hoisting crab, which traverses the cantilever beam, will be able to move out through the shed doorways to pick up loads from the quay and return to place them anywhere in the shed.

All these sheds as well as the others completed since the end of the war have been constructed in brick panelling with steel frames and roof trusses. A departure from this practice has however been made in the case of the new single storey shed at the South side of the Alexandra Branch Dock No. 1. With a quay margin of 12-ft. 6-in. it will be 1,450-ft. long by 88-ft. wide, and for the 92 roof trusses, each with a span of 88-ft., timber is being used in lieu of steel. In this connection we find a strong body of opinion based on experience during war time fires that the early buckling and collapse of metal roof components constituted a danger of some magnitude and that from a fire fighting point of view timber trusses and purlins, despite extensive charring may still function for longer periods and if they collapse, do so without pulling the walls down.

Another new shed is at present under construction at the North side of the Huskisson Branch Dock No. 1. This will be a double storey structure, 1,125-ft. long by 145-ft. wide and have a quay margin of 28-ft. It is being built in reinforced concrete with a shell roof incorporating prestressed beams and its design embodies a number of interesting new features certainly so far as Liverpool is concerned For example, 2 five-ton and 8 three-ton semi-portal roof cranes are being installed on the quayside of the shed, which will prevent interference to traffic on the apron by the cranes' legs, the outer of which travel along the outer edge of a balcony, 11-ft. wide, at upper floor level for the reception of cargo from the slings into the upper floor. On the roadside there will

Post War Developments at Liverpool—continued



Plan showing improvements in Langton and Canada Docks.

be 8 one-ton electric hoists protected from the weather by a continuous overhanging canopy from the roof in addition to the usual gravity lowering jiggers which are standard at Liverpool. As the height of the ground floor of the shed is 24-ft. up to the main beams it has been possible to provide a mezzanine floor to give double storey office, etc., accommodation with a ground floor area of 800 square yards at the East end for H.M. Customs & Excise and the Shipping Company using the berth, without encroaching on the cargo space on the upper floor. There will be a single line of rails inside the shed and double lines on both the quay and the roadside. About two-thirds of the work on this shed has been completed and it will be followed by a shed of similar dimensions and design at the South side, Huskisson Branch Dock No. 3.

Altogether berthage for 23 deep sea vessels with transit shed accommodation covering over 60 acres of floor space have been brought into commission during the post war years.

Apart from the work of new construction the rebuilding and rehabilitation of sheds partially demolished and otherwise damaged have been major engineering operations. They entailed a serious drain of labour and materials and ranged from the complete rebuilding of about 500-ft. of a reinforced concrete treble storey shed at the Gladstone Docks to the replacement of 2,460 steel or heavy timber shed doors, each measuring up to 275 square feet together with their slide rails and runners.

Possibly the most interesting example of restoration was carried out to the shed at the West side of the Harrington Dock. Here the quay margin was increased in width from 5-ft. 6-in. to 13-ft. 3-in. by the construction of a false front to the existing quay wall. The eaves of the dockside wall of the shed were raised as an experiment at eight of the doorways and steel portal frames were erected incorporating an overhead beam carrying pulley blocks through which house falls were run, and operated to the ship's gear to form a union purchase.

These new developments have not however been confined to the provision of accommodation for general cargoes for the facilities for discharging bulk cargoes have also been augmented.

On the 18th August, 1952, discharge commenced on the first cargo of bulk sugar at Liverpool. This cargo consisted of about 4,000 tons of unrefined Jamaican sugar on the s.s. "Sugar Transporter" berthed at the North side of the Huskisson Branch Dock No. 3 where the quay had been specially equipped to handle this type of cargo.

The installation marked the first phase of a scheme of a long term development plan by Tate and Lyle Ltd., who leased the quay space from the Board. About one-third of the war damaged transit shed at the berth was demolished and in its place have been erected 4 six-ton cranes fitted with grabs having a capacity of 2½ tons each. The grabs discharge the bulk sugar into mobile overhead hoppers installed on the quayside behind the cranes. Each hopper holds 25 tons of sugar and can discharge into containers, each holding about 6 tons, mounted on trailers for the conveyance to the refinery.

Since the first cargo was discharged the proportion of sugar shipped in bulk has increased enormously, and the second phase of the development scheme which will gradually reduce cost and time of ship turnround is now almost complete. The shed at the adjacent berth has been demolished and the existing cranes have been transferred there. This was timed to obviate any interruption in the discharging programme and four new cranes of an improved type with the same capacity but designed in accordance with experience gained during the intervening years will be installed at the present berth.

The sugar when grabbed from the ship will be discharged on to a conveyor belt running in a bridge over Regent Road to a weigh tower on the back land. This tower will contain four weighing machines and after weighing the sugar can be delivered to road vehicles for transport to the refinery or delivered into an adjacent silo, 90-ft. high and 543 long. It is of parabolic arch design and will have a capacity of 100,000 tons. This installation will be the most modern of its type in the country and apart from the obvious advantage of speedier handling will obviate the necessity of maintaining a large fleet of road transport which would only be employed part time.

The facilities for the handling of iron ore have also been increased. This became

Post War Developments at Liverpool—continued

necessary when John Summers & Sons Ltd. erected a new blast furnace plant at their Hawarden Bridge Steel Works at Shotton, Flintshire, and a quay 1,000-ft. long at the North side, Bidston Dock was adapted to deal with the additional quantities of ore which they now require. Three 13 ton electrically operated travelling grabbing transporters have been installed each with a capacity of 350 tons per hour. The ore is discharged into hoppers on the transporter structure for delivery to rail wagon, or into a stock pile at the back of the quay. Marshalling sidings with weighing facilities and standage for the equivalent of 171 wagons of 65 tons capacity have also been provided and are connected with the Seacombe to Wrexham section of British Railways.

Two ships of 8,000 tons to 10,000 tons deadweight capacity can berth alongside at the same time and during the year ended June 30 last over 1,270,000 tons of ore were discharged at the quay.

Modernisation and reconstruction has not however been confined entirely to cargo handling equipment and much work of an ancillary nature has been and is being carried out.

The facilities for the embarkation and disembarkation of passengers have been continually under review. As a start the Riverside Station was completely renovated after war damage and the rail tracks renewed and the bridge over the Prince's Dock entrance passage strengthened to enable main line locos to work trains through to the station instead of the small tank engines which previously took over before the train could come on to the dock estate. Later the floating roadway which provides access to the landing stage for vehicular traffic was completely rebuilt. This roadway which is carried on 48 pontoons is 30-ft. wide and 551-ft. long.

The whole of the flooring of the upper deck of the Princess Landing Stage is being renewed and the opportunity taken to cover in the open portion of this deck to provide complete shelter to passengers and their friends. The overhead gantries and gangways which provide access to vessels from the stage are being reconstructed and adapted to correspond with the new deck.

In 1946 a Working Party was set up by the Admiralty and Ministry of Transport to consider certain matters relating to the ship-repairing facilities on Merseyside and they recommended in their report, issued in 1950, that whilst no additional dry docks were required there was a need for improved services and more travelling cranes. It was accordingly agreed with the Mersey Shiprepairers Federation that the provision of these facilities should be dealt with in three separate phases, i.e. firstly, the Langton and Birkenhead Graving Docks, secondly, the Brocklebank and Queens and finally, the Clarence and Herculaneum.

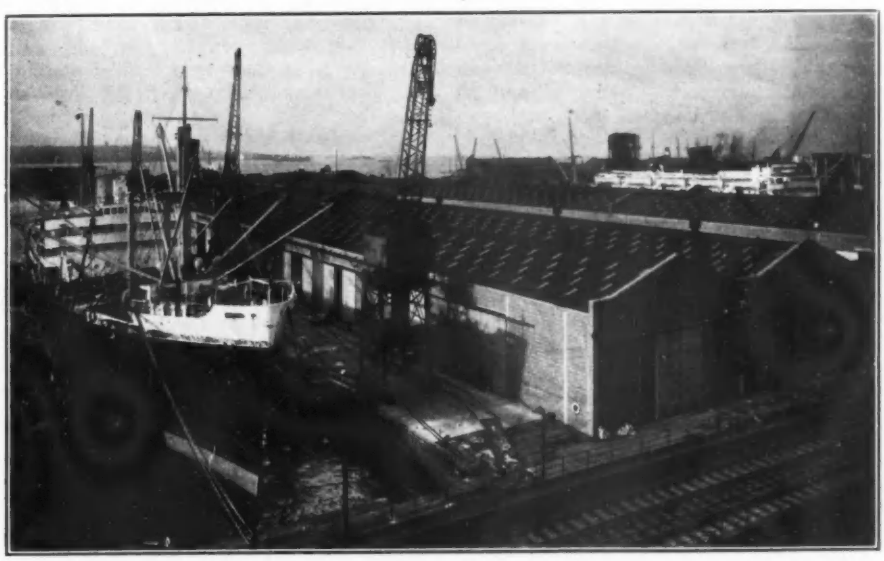
The first phase is now nearing completion and embraces the following work. At the Langton Graving Docks, one 15-ton electrically operated travelling crane with a capacity of 15 tons at 110-ft. maximum and 45-ft. minimum radius and 5 tons at 130-ft. maximum radius, which will enable the centre and far side of the ship to be well plumbed in both docks; a compressed air supply of 2,000 cubic feet per minute, the air lines being fed from three compressors at a working pressure of 100 lbs. per sq. inch and a salt water main fed from an electrically driven pump and carried along the bottom of the docks in a 6-in. bore pipe, the supply being 750 gallons per minute at 50 lbs. per sq. inch to supplement the fresh water which was already available. The electrical supplies are 460, 230 and 110 volts D.C. for supply to ships busbars and 400 volts 3 phase 4 wide A.C. supplying welding transformers and A.C. to ships with a total of 70 connecting points, the same supplies being available for electric appliances and lighting. At the Birkenhead Graving Docks, 2 cranes of similar design to that at Langton Docks are being installed one between Nos. 1 and 2 docks and one between Nos. 2 and 3 docks. The cranes travel on 30-ft. wide tracks to enable each crane to serve two docks. The compressed air supply will be 1,600 cubic feet per minute, the air lines being fed from three compressors and carried along the bottom of the docks in a 6-in. bore pipe with suitable branches. The working pressure will be 100 lbs. per sq. in. A salt water main fed from an electrically driven pump into 6-in. bore pipes in Nos. 1 and 2 docks and a 10-in. bore in No. 3 dock with suitable branches and connections is also being provided. The supply will be 2,000 gallons per minute at 50 lbs. per sq. inch. The electric supplies will be as at the Langton Docks with 86 connecting points.

These new installations will make it possible to dispense with many of the portable appliances, such as welding facilities, air compressors and portable generators belonging to shiprepairers which at the present time are moved between ships under repair whether in graving docks or wet basins.

It has also been necessary to modernise some of the pumping stations. At the Canada Graving Dock and the Toxteth Hydraulic Power Centre the 50 year old pumping plant has been replaced by electrically operated machinery and the Wallasey Impounding Station, which pumps from the river to maintain the water level in the Birkenhead Docks, has been modernised with new pumps and pump house, and intake and delivery culverts, but retaining the existing boiler plant, which had been renewed during the war. Steam-driven centrifugal pumps have been installed so that the station is independent of the electric mains supply.

One of the major post war problems which had to be faced however was the modernisation of some of the older river entrances particularly as the time factor for the docking and undocking of vessels became more and more important.

The first work in this field to be undertaken was the completion of the Waterloo River Entrance Lock which serves the Central system of docks—used mainly by coastwise and cross channel vessels including those which maintain a regular service between Liverpool, Dublin and Belfast. The old entrance to these docks was built in 1868 and as it had only a single pair of gates it could not be used as a lock and the gates could only be opened from 1½ hours before to 1½ hours after high water or roughly 6 hours during each 24. This resulted in a serious loss of working time, for vessels arriving when the gates were closed had to lie at anchor in the river waiting for high water whilst outward bound vessels sometimes had to leave their loading berth long before their scheduled sailing time which resulted, on occasion, in part of their cargo being left behind. The Board had, for many years, realised the need for improved docking facilities for these vessels and the construction of the new lock was authorised as long ago as 1937. Work proceeded satisfactorily until 1939 but the outbreak of war caused it to be considerably curtailed. In 1941 construction was completely suspended owing to blackout difficulties and the diversion of labour to more urgent and essential



New Sheds at North Canada No. 2 and South Canada No. 3 Branch Docks.

Post War Developments at Liverpool—continued

work. Building began again in 1945 and despite shortages of labour and materials good progress was made, and the Lock was opened by Her Majesty the Queen, then H.R.H. the Princess Elizabeth, on March 29th, 1949. It is 450-ft. long and 65-ft. 6-in. wide. It has three pairs of steel mitre gates with timbering fendering and sealing faces each leaf weighing 175 tons, and the sill, which is 17-ft. 6-in. below the level of low water equinoctial spring tides, will allow vessels to enter and leave the docks at practically any state of the tide.

The completion of this entrance enabled a start to be made on the Langton Canada Improvements Scheme, possibly the most ambitious dock reconstruction scheme undertaken in this country in recent years.

The Canada Dock and Lock were opened on the 9th August, 1858, but until the completion of the Canada Basin vessels using the dock had to enter by way of the Sandon Basin and in the meantime the Canada Lock was operated as a dry dock. By a strange coincidence a portion has once again, after almost one hundred years, been used for much the same purpose, namely the building of two of the large steel caissons for the new entrance and passage.

The Canada Basin was eventually cleared and the first vessel passed through the new Lock on September 16th, 1859. This was the Cunard paddle steamer "Asia," a wooden vessel 266-ft. long and 40-ft. beam, which had just completed her voyage from New York. The Canada Dock was so called because it was built primarily to deal with timber cargoes most of which, in those days, came from that country. The entrance lock had been built with what was then the extraordinary width of 100-ft. to accommodate the large ocean-going paddle steamers whose beam, owing to their paddle boxes, would not allow them to use the entrances to the other docks, but soon after it had been completed the paddle gave way to screw propulsion and the beam of the largest vessels of this type rarely exceeded 40-ft.. The great width had not, however, been wasted, for it enabled this lock to be used for the large ships which were developed during the following century, such as the old "Mauretania," "Lusitania" and the "Britannic." The Langton Dock was completed in 1879 and its entrance opened in 1881 by the Prince of Wales. They were named after William Langton who was Chairman of the Board from 1870 to 1876.

From the time of the opening of the Canada and Langton Systems, various improvements and extensions had been carried out to keep them in line with the ever-increasing size and draught of shipping, including much underpinning of walls to facilitate deepening. In recent years, however, the entrances had become less useful as the draught of cargo ships steadily increased, and it was clear that another deep water entrance was necessary so that ships could be docked and undocked for a substantial period of each tide. In addition, the quays and sheds on the west sides of Canada, Brocklebank and Langton Docks were too narrow for the efficient handling of cargo under modern conditions, and the whole area had suffered considerable bomb damage. Finally, the controlling of the old chain-operated timber gates of the Canada Lock was an extremely difficult and hazardous operation in bad weather owing to their exposure to the north-west and the entrances and quays were too obsolete to justify the expenditure of making good the damage and deterioration.

General view of reconstruction work at Langton Dock.

The work is expected to be substantially complete by the end of 1960, the present (1957) estimate of the cost of the full scheme being £17,000,000.

The main feature is a new deep water river entrance into the Langton Dock, 825-ft. long and 130-ft. wide, which will be provided with three interchangeable sliding caissons, operated electrically, so as to divide the locking chamber into two unequal compartments in order to save water and time when the full length of the lock is not required. The caissons, each 113-ft. 6-in. long by 31-ft. 9-in. wide over the greenheart sealing faces by 54-ft. deep from top of plating to sill level, are fitted with heavy mild steel keel flats which slide on granite ways. A standby diesel-driven generator, incorporated in a new Impounding Station, will supply current in cases of mains failure. The side walls of the Lock are of mass concrete, founded on rock 65-ft. to 70-ft. below the coping which is 9-ft. above the high water level of spring tides. Each incorporates a large levelling culvert with a series of outlets communicating with the locking chambers, the flow of water being controlled by hydraulically operated sluice gear, with hand gear as the emergency standby. The floor of the lock is of plain concrete, 3-ft. thick, vented with vertical drain pipes to obviate upthrust from the water-bearing substratum. The part of the new lock which occupies the site of Canada Basin will be constructed in the open after the whole basin has been dammed off from the river. This is being done by first building, under a series of ordinary cofferdams, the permanent mass concrete wall flanking the river side of the outer compartment of the lock. These dams will be braced back on to the temporary steel service gantry which spans the mouth of the basin. Finally, the gap remaining across the mouth of the new lock will be closed by a temporary sheeted dam. A section of the west wall of the new lock has been built in the former Langton Western entrance. Seals will be constructed here and at the former eastern entrance to isolate the northern end of the lock from the basin, so that, in conjunction with the temporary rubble dam already built across the southern arm of the L-shaped Langton Dock, the permanent work can proceed at this end in advance of that at the river end. The remaining two caissons will be erected here, and one installed in the inner working position. After this, the dredging away of the rubble dam and the quays between Langton and Brocklebank docks can be proceeded with.

There will be a minimum depth at low water springs of 19-ft. and a maximum depth at high water springs of 50-ft. This will allow the largest vessels using the port to pass through into the adjoining docks and enable foreign-going vessels of average size to lock in and out eight hours each tide. A considerable saving in the time occupied by this class of shipping entering and leaving the docks will therefore be possible. The existing passage between the present Langton and Brocklebank Docks will be demolished and the passage between Canada and Brocklebank Docks is being completely rebuilt with a width of 130-ft. (to correspond with the entrance) as compared with the former 80-ft., and a sill level to give 40-ft. of water. The water level in the system is maintained at the level of high water of ordinary spring tides by pumping and a new station for this purpose is included in the scheme in order to compensate for any extra water lost due to the operation of the new

Post War Developments at Liverpool—continued

Reconstruction of passage between Canada and Brocklebank Docks.

lock at lower states of the tide than was possible with the old entrances and to make it possible to extend pump impounding to the Gladstone system of docks if required. The quay on the West side of the Canada Dock is being widened on both river and dock sides and considerably lengthened, which is made possible by the removal of the old Canada Lock, and on it is being built a double storey transit shed equipped with electric cranes and railway lines. The West quay of the Langton Dock is also to be widened and a double storey transit shed built there; a single storey shed will be erected on the new quay at the West side of the Brocklebank Dock. Modern transit shed accommodation will then be available for seven cargo liners.

Whilst not a physical development in the true sense of the term considerable improvements have been carried out to the general lighting of the dock estate. Advantage has been taken of the new technical developments in electric lighting and pre-war standards have generally been replaced by modern installations so that night work in transit sheds for instance no longer presents difficulties to men deciphering marks or doing clerical work.

This scheme covers practically the whole of the dock estate and ranges from the complete elimination of the few remaining gas lamps to the provision of completely new electrical transformer stations and installations. It may however be divided under three main heads—Dock Entrances and Passages, Graving Docks, and Transit Sheds and Roadways.

So far as the Dock Entrances are concerned, the Gladstone Lock may be quoted as a good example. This Lock is 1,070-ft. long and was formerly illuminated by six 500 watt tungsten lamps mounted on steel trellis columns about 50-ft. high for docking work with twenty 100 watt lamps on short columns spaced about 120-ft. apart for public lighting. In considering the installation of new lighting it was agreed that such lighting should not in any way interfere with the navigation of vessels either by causing glare or by reason of its colour, and that the quays should be sufficiently lighted to act as a guide to the pilot. The Entrance is now lighted by thirty-three 400 watt fluorescent mercury vapour lamps for docking work and a similar number of 200 watt tungsten lamps for normal illumination, mounted on 25-ft. concrete standards, spaced 85-ft. apart.

The requirements to be met at Graving Docks are, if anything, even more stringent. There should be clear visibility of the quay edges and any obstructions which may be lying about as well as sufficient light to enable repair work to be carried out to any part of the ship. Among the first to be dealt with were the Birkenhead Graving Docks—a group of three—one 939-ft. long and the other two 750-ft. long. Seventy-nine concrete standards with an average spacing of 85-ft. have been provided and each standard equipped with a 400 watt fluorescent mercury vapour type lamp, 25-ft. high for working purposes and a 125 watts similar type lamp, 15-ft. high for public use.

In some of the transit sheds fluorescent lighting has been installed in lieu of tungsten lamps. For example, the new shed at the North side, Huskisson Branch Dock No. 1, which has a ground floor area of about 18,000 square yards is being equipped, on that floor, with 120 twin 5-ft. new warm white tubular fluorescent fittings which will provide four times as much light as filament lamps with equal current consumption. Attached to the shed on the roadside and quayside there will be a total of 48 similar lighting fittings and in the avenue at the rear of the shed twelve 25-ft. concrete columns equipped with 400 watt fluorescent mercury vapour fittings.

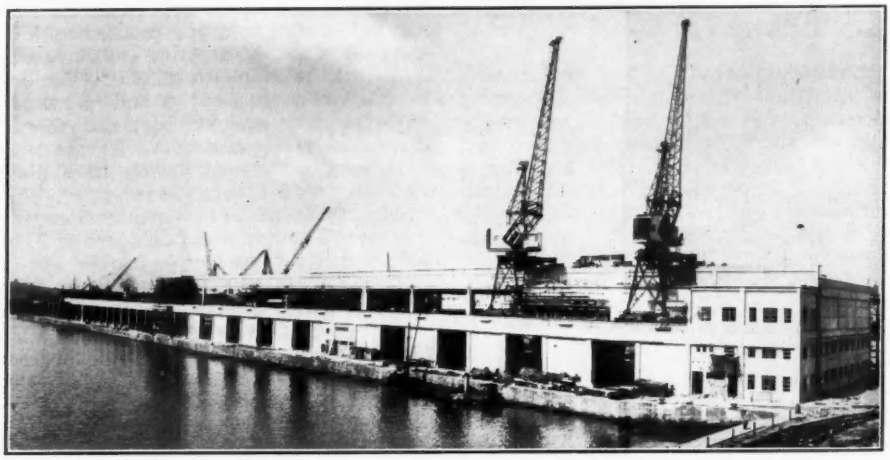
All these works are directly related to the handling of cargo or the movement of the ship in or adjacent to the dock system. The Dock Board are however responsible also for the Conservancy work of the port and the plant used in this branch of their activities must be maintained in an efficient state notwithstanding the continuous demands made by civil engineering development. During the war the Board's large fleet of vessels used for pilotage, dredging, salvage, lighting, buoying and surveying suffered badly through lack of refitting and replacement. Since the end of the war however the Board's fleet has been augmented by the building of two Pilot Boats, two Salvage and Conservancy vessels, three Grab Hopper Dredgers, one Bucket Ladder Dredger, a Survey Tender, a Survey Launch and a Tug. Two more Grab Dredgers, a Stone carrying Hopper and a new Pilot Boat are at present under construction.

The designs of these vessels incorporated many new features. For example, under modern conditions Grab Hopper Dredgers should have the maximum capacity for spoil and yet be of a reasonable size; they should be able to load in two to three hours; be of good seaworthiness to cope with the worst weather conditions when proceeding to or from the dumping grounds and have sufficient speed to enable them to leave the dock in which they are working and return after dumping their load before the dock gates are closed on the ebb tide. To meet these requirements the new vessels have diesel-electric bridge controlled propelling machinery in place of steam reciprocating engines. The first to be delivered is 237-ft. long and has a beam of 40-ft. 6-in. She has a loaded draught of 14-ft. 6-in. to allow her to work in shallow waters and a maximum speed of over twelve knots. She is fitted with three grabs lifting 3½ tons each and can load 1,350 tons of spoil from dock bottom in 110 minutes.

Another interesting post-war vessel is the "Vigilant," one of the two ships employed on salvage work, fire fighting and buoyage. She was commissioned in 1953 and has a gross tonnage of 728. She is a twin-screw steamer having the following principal dimensions: length 172-ft. 6-in., breadth 35-ft. and depth (to main deck) 16-ft. 6-in., with a mean load draught of about 11-ft. Forward of the bridge, on the main deck, is located the main deck auxiliary machinery, a 20-ton steam winch, two 10-ton electric capstans just aft of the main hatch, and a 5-ton warping and cable capstan on the port side for working the anchor, which is recessed into the starboard shell. A 4-ton warping capstan is fitted aft and the steering gear is of combined hand and electro-hydraulic type. Accommodation for the ship's officers and engineers is in the aft end of the bridge house, comprising single-berth cabins for master, mate, chief and second engineers, wreck master, and steward, with mess-saloon and pantry. The crew, 14 in number, are in two-berth cabins on the lower deck aft, with a common mess for seamen and firemen. Forward of the engine-room casing, accommodation is provided for six salvage engineers, and below, on the lower deck, immediately forward of the machinery space, double-tier berths are provided for a wreck party of 11, and a separate cabin for two divers. A marine sur-

Post War Developments at Liverpool—continued

veyor and two assistants can be berthed in single cabins at the fore end of the bridge deck. A combined dining saloon and lounge seats 10 persons. Aft of the wheelhouse, on the navigating bridge deck, is the surveying room and plotting table. The vessel is fitted with a special heavy bow casting capable of taking a load of 100 tons, and suitably arranged on the forward main deck are bollards, samson posts, eyeplates, and fairleads to cope with heavy salvage operations. Also arranged to line up with the bow casting is an anchorage to take a 100 ton purchase. The foremast is equipped with two derricks, the aft derrick with separate purchases to take 5-ton, 12-ton and 15-ton lifts, and the fore derrick with purchases to take 5-ton and 10-ton lifts. In the hold and 'tween deck forward are stores, storage space for salvage gear, etc. The vessel is also fitted with a powerful fire and salvage pump driven by a 435 h.p. motor having a capacity on fire duty of 440 tons of sea water



New Shed, North Side, Huskisson Branch Dock No. 1.

per hour at 230 lb. per square inch at the base of the monitors.

The two post-war pilot boats also set a new standard for this class of vessel. The "Edmund Gardner" which was commissioned in December, 1953, is 165-ft. long and has a beam of 31-ft. 6-in. and a mean draught of 14-ft. 6-in. She is diesel electric propelled and has accommodation for five officers, 18 apprentices, and crew of 32 pilots. Pilots' cabins are on the lower deck, having access from their enclosed promenade through public rooms, including an entrance on the boat deck, and dining saloon and lounge on the main deck, all conveniently grouped and provided with emergency exits to boat stations. Apprentices are housed aft and have a combined dining and recreation room.

Two new Floating Cranes, the "Titan" and "Atlas" have been added to the Board's fleet. The "Titan," delivered in 1952 is fitted with an electrically driven crane of 25 tons capacity at a maximum radius of 60-ft., the deck cargo capacity being 120 tons. The "Atlas," commissioned in 1955, has a similar crane with a lifting capacity of 100 tons at a maximum radius of 40-ft. which enables her to deal efficiently with dock gates. It is also fitted with an auxiliary block of 15 tons capacity at a maximum radius of 100-ft. and has a deck cargo capacity of 160 tons. Both vessels have twin screw steam propulsion and are designed with the cargo space amidships.

One of the most spectacular post-war developments however has been in the field of ship to shore communications and port radar. During the war serious congestion and delays to shipping were experienced due to the simultaneous arrival of large numbers of ships in convoy, which could not all be handled on one tide. Wireless telegraphy or medium frequency radio telephony could not be used to regulate their movement for security reasons but with the assistance of the Army authorities a short-range high frequency radio-telephone system was eventually adopted and six shore stations established at the various dock entrances with Gladstone as the main station. Each pilot took with him one of these "walkie-talkie" sets when he boarded an inward bound ship at the Bar and was so able to receive his docking instructions without delay. This communication system proved so valuable that it was decided to continue its use after the end of the war.

The Port Radar Station was opened in 1948. This installation, with its six display units, provides a series of large-scale pictures of the sea channels and the river and enables a vessel to be supplied with minute-by-minute information about her position, the course she is making and the positions of other vessels in her vicinity. The control of a vessel must however remain in the hands of the master and the pilot, and the information from the station is provided purely as an aid to navigation, no direct orders being given about speed or the course to be steered. Details of position are usually given in the form of a running commentary from the station, its reception by the ship being acknowledged as necessary. Vessels have entered with radar assistance from positions as far as eight miles seaward of the Bar Lightvessel, the passage occupying over two hours, continuous positional information being supplied to the vessel during the whole of this period. Five vessels have been assisted at the same time, one operator using one Channel to distant vessels and a second operator using another Channel to vessels nearing the mouth of the river or in the river.

Since the Station was opened over 4,500 vessels have been assisted in this manner when entering the port during low visibility. The majority would have been delayed in the absence of such assistance. The station also handles docking and berthing instructions for vessels; weather and visibility information from lighthouses, lightvessels, coastguards, etc., in Liverpool Bay and the river; operational messages concerning buoyage, dredging and shipping casualties and the distribution of navigational warnings concerning casualties to sea marks, shoal soundings, etc. It will be appreciated that an essential factor in the working of the Port Radar Station is an efficient two-way communication system between the master or pilot of the vessel and the operator at the Radar Console. After a few years work the original army sets became unserviceable and in 1950 a new V.H.F. system of communication was installed. This now covers ten shore stations—the Port Radar Station, Dock Entrances and Eastham and 150 portable sets for the use of the pilots.

Since the original radar installation was designed a number of components such as valves have become obsolete and cannot be readily replaced.. There have been many advances in radar technique, particularly in the degree of accuracy obtainable and the Board have, recently, placed a contract for the installation of new equipment which will enable an even more efficient service to be given in the future.

This will provide an improvement in range and bearing discrimination and picture clarity for there will be an additional console and an increase in range from twenty to twenty-five miles. The equipment will be housed in a new building adjacent to the present station.

Much thought has been and is being given to the design and layout of the many and diverse facilities which are being provided and the advice of Shipowners and Stevedores has been invaluable in deciding the many problems which have arisen particularly in connection with the rebuilding and equipment of transit sheds.

About £25,000,000 has so far been spent on development and reconstruction work at Liverpool during the last 10 years and whilst the problem of finance does not come within the scope of this article it is one which must always be foremost in the minds of Port Administrators. Physical needs must, of necessity, be carefully balanced against the cost of each item of work but rising costs, both of labour and materials, play havoc with long term financial planning.

We feel convinced, however, that although the rehabilitation of the port is by no means complete, the work that has been carried out since the war together with that which is planned for the future will play a great part in keeping this country well to the fore in port design and equipment.

Electrical Distribution as applied to Docks

Section IV. Switchgear

By C. H. NICHOLSON, M.I.E.E., M.I.Mech.E., F.R.S.A.

(Continued from page 353)

H.V. Switchgear

The types of H.V. Switchgear suitable for dock distribution available at the present time may be summarised as follows:

Switchgear incorporating oil immersed circuit breakers designed as below:

(a) Cubicle type having interlocked doors back and front and provided with interlocked isolators.

(b) Draw out truck type with horizontal isolation whereby the circuit breaker, current and voltage transformers, relays and connections are completely withdrawn for inspection and repair, from the cubicle containing the bus bars and connecting sockets. The bus bar chamber is completely shrouded and the horizontally disposed outlet sockets for the main circuit and the subsidiary circuits (as voltage transformer service) are automatically closed by shutters upon withdrawal of the truck. In order to prevent withdrawal of the truck when the circuit breaker is closed a mechanical interlock is provided together with a padlock to prevent unauthorised withdrawal of the truck.

(c) Draw out truck type with vertical isolation brought about by lowering the circuit breaker from vertically disposed socket connectors. In this type the current and voltage transformers together with the relays etc. are permanently fixed in the cubicle the vertical socket outlets being provided with shutters which automatically close the socket outlets upon withdrawal of the circuit breaker. The bus bar chamber as in the case of the horizontally isolated switchgear is completely shrouded.

Switchgear of the above types (a), (b) and (c) is provided with bus bars in air supported on insulators although moulded insulation is sometimes provided, and as a further safeguard taping of the bus bars may be resorted to. The duty limit of truck type of switchgear (b) and (c) is in the range of 11 K.V. having a rupturing capacity of 250 M.V.A. and cubicle switchgear (a) can be designed for 33 K.V. at a rupturing capacity of 500 M.V.A.

(d) Metal clad, fitted with horizontal isolation comprising a fixed stationary structure containing the bus bars, current and voltage transformers, relays and instruments, together with the isolator socket outlets which as in the truck type of switchgear are automatically shuttered, and a moveable portion which carries the oil immersed circuit breaker. The moveable portion is generally carried on a rack enabling the circuit breaker unit to be racked out for isolation purposes and also to be locked into postion when in service. Interlocks between the isolation mechanism and the circuit breaker are provided in order to prevent withdrawal under load and a padlock prevents unauthorised isolation.

The whole of the ironclad bus bar system up to the isolator socket outlets and including current transformers is entirely filled with compound thus sealing the H.V. connections from the cable to the isolators.

(e) Metal clad filled as (d) but with vertical isolation. Both (d) and (e) are suitable for duties considerably in excess of 11 K.V. at 250 M.V.A.

Switchgear incorporating air break circuit breakers.

(f) Cubicle type switchgear fitted with a withdrawable air circuit breaker, the current and voltage transformers, relays and instruments being permanently fixed in the cubicle. The circuit breaker isolation being effected by shuttered socket outlets. The voltage limit for this type of circuit breaker is 3.3 K.V.

(g) Fused switchgear generally of the cubicle type comprising an oil immersed on load isolator or switch of low rupturing capacity capable of breaking normal full load and overloads, short circuit currents and heavy overloads being dealt with by high rupturing capacity fuses preferably provided with trips operating on the common trip bar to ensure firstly complete isolation of the circuit and secondly to ensure that a single phase fault trips all phases. Off load isolators and interlocks are provided to give safety to maintenance personnel when inspecting and repairing.

The rupturing capacity limit is dependent upon load rating and for 11 K.V. operation is approximately 400 M.V.A. at 30 amperes being reduced to 300 M.V.A. at up to 100 amperes full load fuse rating.

With a prospective fault level of 14,000 amperes at 11 K.V. representing 250 M.V.A., H.R.C. fuses rated at 100 amperes will cut off the current under fault conditions at about 7,900 amperes thus considerably reducing stresses and heating effects due to fault current.

Whilst fused switchgear may be provided with relay gear, shunt trip coils, and possibly voltage transformers, if directional protection is required this leads to expense and rather defeats the object of fused switchgear which is to provide short circuit protection together with simple overload and possibly earth leakage protection at the lowest cost commensurate with safety.

The characteristics of the types of switchgear described above are now examined in detail.

(a) The cubicle type is less complicated than the draw out type if, however, interlocks are not provided, and full reliance is placed upon the maintenance staff operating isolators correctly, there is, an element of danger. The provision of mechanical or electrical interlocks is somewhat difficult and these are relatively easy to defeat. If the switchgear is connected to a network then it is essential that incoming and outgoing isolation is provided. The economic limit is 11 K.V. at 500 M.V.A. The bus bars are usually carried on insulators in air and are thus easy of access for repairs.

(b) The horizontal draw out type truck cubicle is a very satisfactory design giving complete isolation not only of the circuit breaker and main connections but also current and voltage transformers, relays and instrument wiring. The whole of the apparatus comprising the switchgear is extremely accessible for maintenance purposes when the truck is withdrawn, and further, the components which remain alive in the fixed portion of the cubicle are completely shuttered automatically as the truck is withdrawn. The bus bar construction is usually as (a).

The vertical isolation type has the same characteristics as (b) except the current transformers, voltage transformers are permanently fixed in the stationary cubicle thus only the circuit breaker is removed and isolated. Both types are more expensive than (a) the horizontal draw out type being slightly more expensive than vertical isolation switchgear and also requires more space in front of the switchboard. The duty limit is in the range of 11 K.V. at 250 M.V.A. Both types have full interlocking features and afford a high degree of safety to maintenance staff.

(d) and (e) Metal clad compound filled switchgear gives the maximum safety to personnel as all fixed current carrying conductors at high voltage are encased in robust metal housings filled with insulating compound. Interlocking is very complete and even to the extent that the circuit breaker cannot be closed unless the isolating plugs and sockets are fully engaged and also oil switch tank is in position. Fire hazard is considerably reduced in view of the enclosure and further each unit is completely isolated. The space required is less than that required by any other form of oil immersed switchgear, see Fig. 4.1 which is to comparative scale. Against these advantages this

Electrical Distribution as applied to Docks—continued

type of switchgear is the most expensive and there is not the accessibility for maintenance purposes that is available with either (a), (b) or (c) with particular emphasis on (b). The duty limits are extremely high and much above anything required on the largest dock system the voltage limit being in the range of 132 K.V. and the bus bar current carrying limit in the order of 4,000 amperes, the maximum duty of the circuit breaker, of course, defining the rupturing capacity of the switchgear.

(f) Cubicle type air break switchgear takes up less space and may be tiered. The fire hazard is small due to the absence of oil and the circuit breaker may be isolated and withdrawn for maintenance purposes. Air break switchgear is slightly more expensive than oil immersed switchgear at the present time for current ratings less than about 1,600 amperes. The maximum duty for which this type of switchgear has been designed up to the present is 3,300 volts at 150 M.V.A.

(g) Fused switchgear takes up little space and is the cheapest form of H.V. Switchgear. Where simple protection is required as for isolated feeders, small rectifier units, auxiliary plant etc. or in any situation where complicated network protection is not

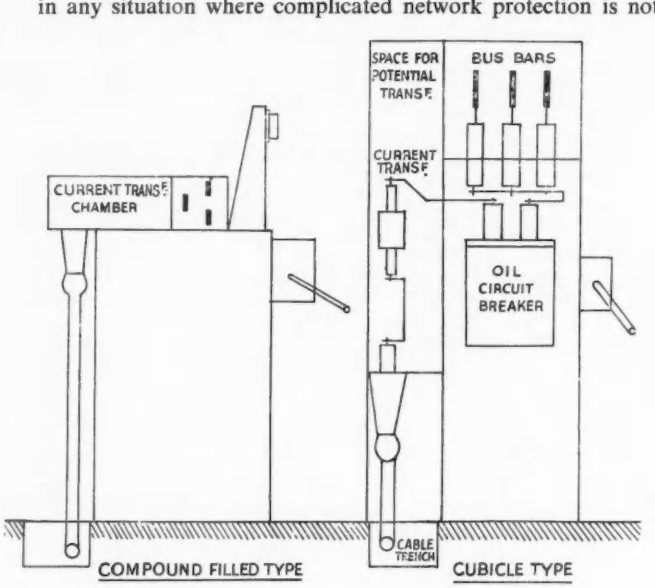


Fig. 4.1.

necessary fused switchgear has the advantage of simplicity and minimum maintenance. The disadvantage is fuse replacement and consequent cost, and where it is known or anticipated from experience that fault incidence is high, consideration should be given to types embodying full circuit breaker protection.

L.V. Switchgear

The same types of switchgear as those given for H.V. operation are available for low voltage systems, the rupturing capacity, however, being smaller in view of the reduction in voltage. Air break switchgear, however, is now available in ratings up to 3,000 amps. and having rupturing capacities of 15, 25, 35 M.V.A. at 400 volts, tiered switchboards further reduce the space required. A switchboard incorporating air break circuit breakers may be arranged in switchboards as follows: (Fig. 4.8).

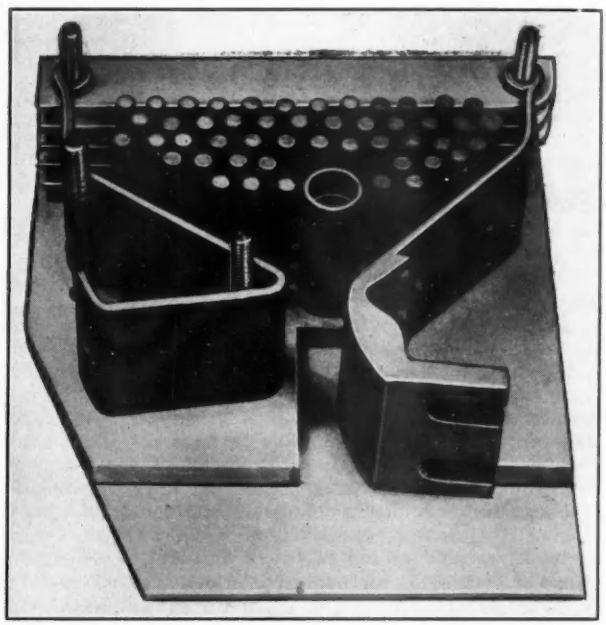
Single tier from 2,000 amperes rated capacity.

Double tier up to 1,600 amperes rated capacity.

Four tier up to 225 amperes rated capacity (American practice).

Contactor Circuit Breakers with high rupturing capacity "back up" fuses (Fig. 4.4).

This type of switchgear requires less space and may be tiered usually in cubicles providing with incoming and outgoing isolators



[Courtesy of Metropolitan Vickers

Fig. 4.2.

which incorporate the "back up" fuses. The cost is slightly less than orthodox air break circuit breaker or oil immersed switchgear and the provision of relays for earth leakage and fault discrimination presents no difficulties. Normal overload protection is afforded by the contactor circuit breaker up to say 6 times full load with time lag features which may be definite or inverse time limit, the H.R.C. fuse taking control, by virtue of the current chopping characteristics, only in case of high fault currents. In this manner the contactor circuit breaker, current transformers and cables etc. are relieved of the electric, magnetic and consequent mechanical stresses which occur when full fault current is carried for the period between the incidence of the fault and the opening of a conventional circuit breaker which is in the order of .2 second.

As an example a contactor circuit breaker controlling a circuit having a full load rating of 100 amps. and a prospective fault current of 50,000 amperes at say 400 volts, 3 phase, representing a fault level of 35 M.V.A., if provided with "back up" H.R.C. fuses of 100 amperes rating will have a "cut off" current of 5,500 amperes equivalent to 4 M.V.A. only.

All circuit breakers have two or more contact systems, one the main current carrying contacts and further contacts which are the arcing contacts protecting the main contacts from damage. Reference to Fig. 4.2 shows that the arcing contacts always make contact prior to the main contacts and break the circuit after the main

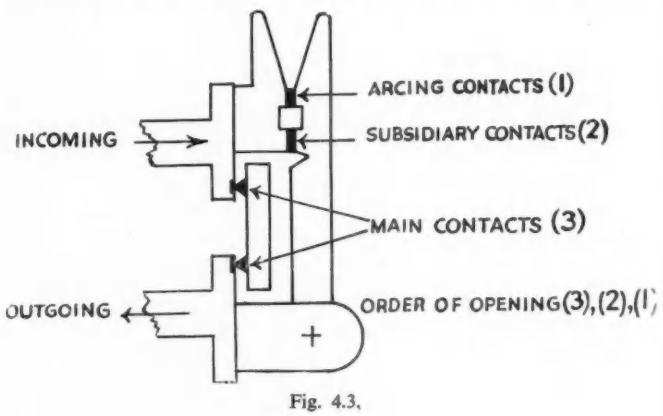


Fig. 4.3.

Electrical Distribution as applied to Docks—continued

contacts have opened. In some air circuit breakers Fig. 4.3 a further set of subsidiary contacts is provided.

The operation of circuit breakers may be manual, spring operated, solenoid, or motor.

H.V. manually operated circuit breakers are usually limited to 150 M.V.A. on account of the physical effort required to close the circuit breaker.

Spring operated circuit breakers are closed by the action of a spring which has been compressed by a lever operated ratchet the "closing" trigger releasing the spring and thus operating the closing mechanism. Indicators are provided to show "spring charged" circuit breaker "open" "closed" and the closing action is very positive and does preclude damage due to operational errors particularly when closing on a fault.

Solenoid operated circuit breakers have the advantage that the control device operating the circuit breakers may be remote from the actual circuit breaker and whilst failures of modern circuit breakers are rare, remote control does introduce a further element of safety whereby the actual circuit breakers may be installed in a fireproof chamber not occupied by personnel. The operating mechanism is relatively costly and the power requirement for an H.V. 250 M.V.A. circuit breaker is in the range of 7/10 K.W.

A schedule of L.V. circuit breakers manufactured by a prominent maker is given below to indicate the average rupturing capacity together with the normal current ratings of L.V. breakers available.

Truck Type Oil Circuit Breakers.

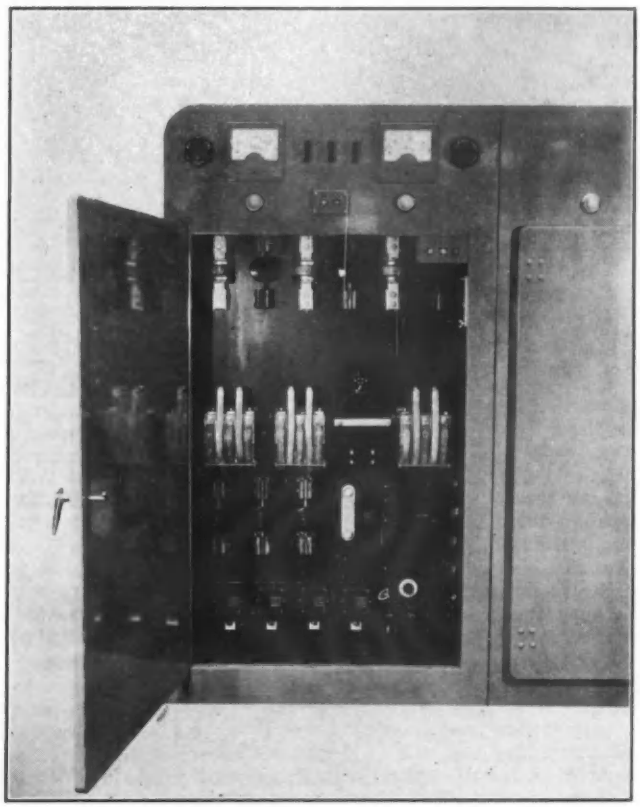
Amps.	M.V.A. Rupturing Capacity
200/400	16.5 at 660 volts
	10 „ 400 „
200/800	25 „ 660 „
	15 „ 400 „
400 (min.)/1200	40 „ 660 „
	25 „ 400 „
800 (min.)/3000	50 „ 660 „
	30 „ 400 „
Switchboard Type.	
300	15 „ 660 „
	10 „ 400 „
800	25 „ 600 „
	15 „ 400 „
1000	50 „ 660 „
	25 „ 400 „
1600	50 „ 660 „
	30 „ 400 „
Pedestal Mounted Floor Fixing Gear	
20/250	16.5 „ 660 „
	10 „ 440 „
	25 „ 660 „
50/600	15 „ 440 „
	40 „ 660 „
50/600	25 „ 440 „
	50 „ 660 „
400/1600	30 „ 440 „
Unit Type Switchboard	
200/400	16.5 „ 660 „
	10 „ 400 „
200/800	25 „ 660 „
	15 „ 400 „
400 (min.)/1200	40 „ 660 „
	25 „ 400 „
800 (min.)/3000	50 „ 660 „
	30 „ 400 „

[Courtesy of G.E.C. Ltd.]

Circuit Interruption

In all electric power circuits it is necessary to provide some device which will interrupt the circuit and thus cut off the electric supply in the event of overload or fault conditions arising. Overload conditions are relatively easy to deal with as the currents involved may reach as a maximum, approximately not more than 6 times full load current (a stalled induction motor for instance). Fault conditions, however, due to the general increase in the size of generating units and consequent increase in the cable section comprising the H.V. network, have become very severe and most H.V. industrial power services are capable of delivering under fault conditions not less than 250 M.V.A. or 250,000 kilovoltamperes at the point of supply thus representing at 11 K.V., a current of in the order of 13,000 amperes.

In any circuit breaker whether it is an oil immersed circuit breaker, air circuit breaker, or fuse the problem is to build up resistance between two contacts which are moving apart in order to break the circuit and so quench the arc being drawn out in the



[Courtesy of Walsall Electrical Co. Ltd.

Fig. 4.4.

ionised path between the two contacts and thus prevent restriking of the arc after the current has passed through zero.

Circuit interruption in alternating current systems presents less difficulty than in continuous current systems because of the fact that the current and voltage pass through zero each half cycle i.e. on a 50 cycle system 100 times per second. If the voltage and current are in phase then both current and voltage pass through the zero at the same time, but if 90° out phase, i.e. the power factor is zero, then when the current is for instance at zero the voltage is at a maximum and circuit interruption is made under the most difficult condition, as when the current is ceased in the circuit the recovery voltage and hence the restriking voltage under the same circuit conditions is a maximum (up to twice peak voltage). In practice circuit breakers of the oil immersed type rarely break the circuit under 2 to 3 half cycles and may take as long as up to 10 half cycles.

The plain type of oil immersed circuit breaker having no arc control devices, and suitable for a rating not exceeding 11 K.V. at 150 M.V.A. is dependent upon the following factors in order that the current may be interrupted, length of break, speed of break, turbulence of the oil in the contact area which in turn is dependent

Electrical Distribution as applied to Docks—continued

[Courtesy of Metropolitan Vickers

Fig. 4.5.

upon the head of the oil above the contacts. This type of breaker now only made for relatively small duty, is also subject to high tank pressures.

By the use of arc control devices as shown in Fig. 4.5 the gases produced by the arc force oil across the arc path and thus introduce resistance the arc being lengthened by being blown out sideways. The introduction of resistance also beneficial from a restriking voltage point of view as this voltage is oscillating in character and the frequency of oscillation is

$$\sim = \frac{1}{2\pi}\sqrt{\left[\frac{1}{LK} - \left(\frac{}{R.K.}\right)^2\right]}$$

Where K = circuit breaker capacitance and L = inductance and R = resistance at the time of current interruption.

Air circuit breakers, achieve current interruption by high speed of break, magnetic blow out devices which by magnetic action lengthen the arc by forcing it into a de-ionising chamber or chute provided with a number of insulating plates of non combustible material which split up or divide the arc into sections (Fig. 4.6 and Fig. 4.2). Arc extinction is very rapid and may be forced before natural extinction occurs at the current zero. Air break switchgear is shown at Fig. 4.8.

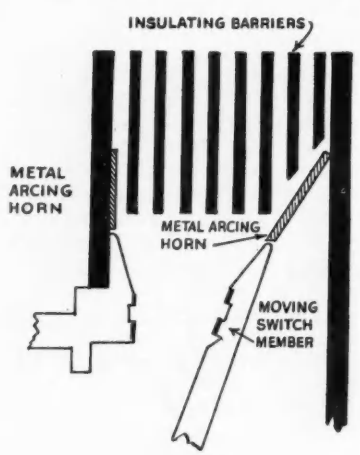


Fig. 4.6.

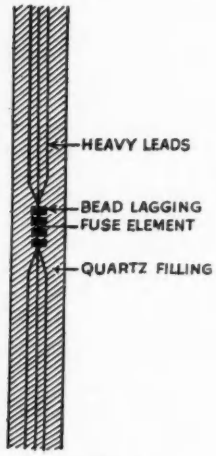
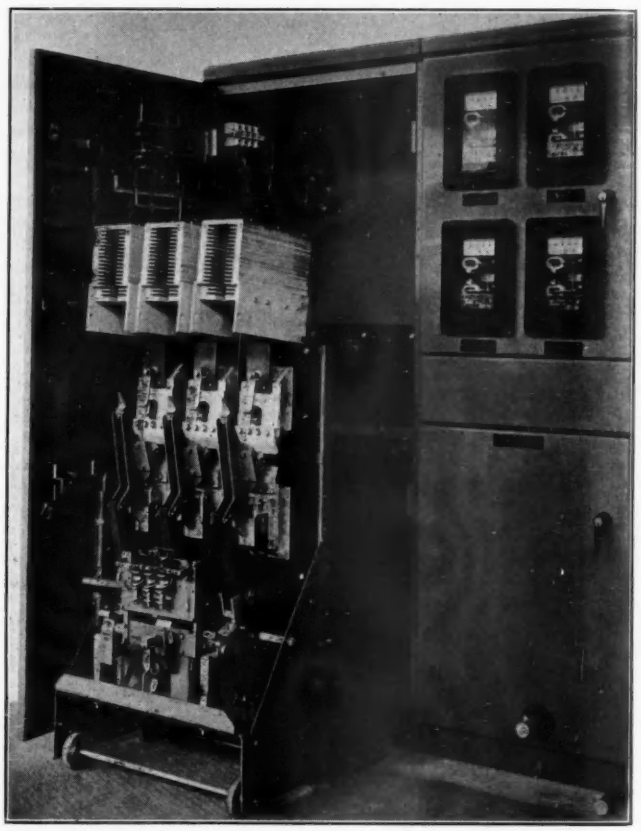


Fig. 4.7.

Fuses

These may be divided into 3 classes:

(a) The rewirable type consisting of a holder of glazed porcelain or moulded insulation provided with terminals between which the fuse wire is carried, a moulded asbestos tube or channel being incorporated in the design to prevent spattering of the molten fuse metal. The rupturing capacity of this type is not more than 4,000 amperes and thus on a rated voltage of 400 volts has a rupturing capacity of about 3 M.V.A. only. There is also the disadvantage that the size of the fuse and hence the current rating can be increased, the final result usually being the complete destruction of the fuse holder.



[Courtesy of G.E.C. Ltd.

Fig. 4.8.

(b) Cartridge fuses consisting of a tube of insulating and preferably non combustible material containing the fuse wire, the tube being tightly packed with an inert powder as chalk, sand, mica, quartz etc. Fuses of this type may be rewirable or expendable and are more satisfactory than type (a).

(c) **High Rupturing Capacity (H.R.C.) Fuses.**

The advantages of the above type of fuse may be summarised as follows:

(1) High current rupturing capacity.
(2) Due to complete enclosure does not deteriorate.
(3) Operation speed is high.
(4) Consistent performance.
(5) Consequent upon above discrimination is reliable.
(6) A definite " cut off " effect below prospective fault levels.
(7) Inverse time/current characteristic.

Electrical Distribution as applied to Docks—continued

(8) For commensurate performance has the lowest cost of any form of circuit interruptor.

The disadvantages are:

(1) Is not suitable for forms of protection requiring directional characteristics.
(2) Lack of earth leakage protection other than that obtained by virtue of overload conditions consequent upon an earth fault.
(3) The time and cost of replacement.
(4) With standard fuses single phase operation can occur due to a fuse in one phase only blowing.

Two general types of H.R.C. fuse are available the standard and the tripping fuse, the latter having a small chemical capsule incorporated which is provided with a shunt fuse to which the fusing current is transferred after the main fuse has blown. The chemical charge is thus fired and ejects a striker pin which operates the common trip bar or tripping circuit for the low duty circuit breaker contactor, or on load isolator.

The general construction of a typical standard H.R.C. fuse comprises relatively short silver fuses fitted into a ceramic container and packed with quartz or similar powder, Fig. 4.7.

The circuit interruption by the operation of the fuse is briefly:

(1) The silver element melts and vaporises followed by
(2) Fusion of the filling powder and extinction of the arc

and the electrical phenomena consequent upon the above physical changes are:

(1) The creation of a high resistance.
(2) The change of the high resistance above to an insulator due to decrease in fuse current and the high temperature generated.
(3) The production of a transient voltage (restriking voltage).

The control of physical and electrical phenomena in order to produce the excellent characteristics of the H.R.C. fuse include:

Minimum time of arc extinction, control of transient voltage and a high rate of temperature decline in order to reduce the pressure within the ceramic body of the fuse.

A typical performance of a (H.R.C.) fuse is given below:

Rating	30 amperes
Voltage	500
Prospective current (R.M.S.)	54,900 amperes
Prospective current (peak)	117,200 amperes
Cut off current	2,100 amperes equivalent to 2 M.V.A.
Time taken to clear	.0025 second
Power factor	.22 or 22%

Economical Timber Handling

Need for Co-Ordinated Planning

By A. GORDON

A dispassionate observer at the Conference of the Timber Trade Federation of the U.K. in Manchester last September must have left the meeting filled with a cynical amusement. Such amusement might have been tempered by some sympathy for a great industry, hampered by many factors not under its own direct control, but nevertheless apparently lacking all foresight and co-ordinated planning.

From the papers presented and the discussions that followed, there emerged a rather chaotic picture that was, to put it mildly, puzzling to anyone not directly concerned with the trade. This chaos seemed to fall clearly under two distinct, yet interlinked headings:

(1) those factors which are the concern of the timber trade itself, within its own boundaries; and
(2) those factors which involved industries other than the timber trade.

The outstanding impression that one gained under the first of these two headings is that the timber industry is divided into two very sharply defined bodies—namely the producers and the importers—and that little or no co-ordination of policy exists between the two. This may be a false impression, but one could not help but feel that the situation seemed to be: "You want some timber? Right, that is what you can have, make the best of it."

The second impression left very strongly was a complete lack of coherence as to what the timber trade in the U.K. wanted for itself. One paper suggested that the trade, as a first step, adopted a standard "set"; this proposal was generally ignored, or else criticised as being impracticable. Is it?

At almost every stage of the movement of sawn timber, a "set" of some sort is used; and to the layman, standardisation would seem to be an obvious move. Ignoring the stage "ship to shore or lighter" for the moment, is there any reason why the movement of large quantities should not be standardised for yard/road/rail movement?

It would appear that the whole crux of the matter turns on one question—why is it necessary for the **importer** to bring in such a wide range of lengths?

The timber trade in the U.K. as a whole may be made up largely of small firms who handle small quantities of widely differing sizes of timber; but is that any reason why the importer or even the mill should handle this variety? Has it not always been an accepted tenet that the small buyer has to put up with certain inconveniences compared with the "big man"?

Naturally, the owner wishes to get the best possible financial return from every tree he cuts, but must all that return come from **length?** Some of the tree goes for pulp, a commodity already commanding a high price, which appears to be likely to continue for a long time to come. Surely then an extra few feet off length on to pulp is an obvious and economic proposition from the owner's point of view; while easing the problem of board cutting to a noticeable degree.

These questions lead naturally to the second heading, which is to raise questions of handling methods; and in this the timber trade is not alone in its problems. Someone invented the fork-lift truck—primarily for moving a limited range of goods under favourable conditions, namely in the factory. The fork-lift truck has its uses, no one can deny that fact; but it is not the answer to **all** handling problems, in spite of what its manufacturers may say. Nor was it ever designed for port working; and what is more important, neither will its manufacturers — in fact, the majority of mechanical handling equipment manufacturers—pay any attention to the specific needs of the port industry; that industry can take what it is given and be thankful for such condescension! Perhaps this attitude was best illustrated by the announcement during the Manchester Conference that British Railways were at last considering the introduction of vehicles that would carry timber flat! Another pointer was the fact that no mechanical handling expert (!) contributed to the various discussions; no, they were all too busy organising demonstrations of what any schoolboy knew this equipment could do.

A curious point about the manufacture of mechanical handling appliances is that, with few exceptions, no one ever appears to approach the market first to find out exactly what is needed; rather do the manufacturers produce something to their own ideas and then adopt a "take it or leave it" attitude; which is perhaps why a well-known port operator was recently heard to say that there was only one way to handle timber and that was by an adequate number of men using their hands!

In 1953, the International Cargo Handling Co-ordination Association organised a conference in London on timber handling. At this time, the industry was still "under control"; but enough emerged to confirm to the Association the need for its services in various problems. This work has gone on quietly and steadily through the past years, in spite of innumerable difficulties, and it well may be that the result of the two conferences conjointly, will bring about positive results.

More and more it is being recognised that the "unit load" is, from every angle, the most economical method of handling cargo,

Economical Timber Handling—continued

particularly if mechanical aids are to be used; and it is in the rapid development of the unit load that the timber trade can best right itself. The International Cargo Handling Co-ordination Association has been, and is, working on those lines through its Scandinavian membership; but the industry as a whole in this country appears to give little active support.

Sawn timber has to be sorted to length; where is the obvious place to do this? **At the mill as it is cut.** Then, even if it calls for some reorganisation in that section of the industry, the unit load of even length is a simple and logical outcome. It has been said that this would be a costly business; it need not be, given intelligent and co-operative planning by all concerned.

Surely no one, by even the widest stretch of the imagination, can justify single piece handling as far as dock working is involved; for not only will the ship turn-round be quicker, but actual loss of timber can be avoided by use of the unit. Reducing cost, plus actual physical labour saved, is worth considering; the more so as many importers seem to be finding difficulty in keeping their labour force up to a strength adequate to cope efficiently with the existing system.

Naturally, the lay-out of a timber storage yard must, to a large extent, be governed by the area available; but even in yards of similar size, there seems to be widely divergent thought as to what constitutes the best method of utilising space. Lay-out must of necessity affect methods of handling as between shipside and stack; but if sorting is done at the beginning of transit, instead of at the end, much ground space would be saved.

One argument against the unit load is the uncertainty regarding drying before packaging; surely this can be overcome.

Methods of stacking are a matter for the importer to decide for himself—crane or fork-lift, many arguments can be marshalled for and against both methods. In regard to the former, it is rather interesting and significant to note that a special clamp was devised in this country for use with a unit load crane-lifted, which had the merit of working efficiently. Would any equipment manufacturer make it? No! Would anyone have it made for themselves? No! although its owner demonstrated its value up to a 2½ ton load. But the fact remains that the unit of even length, discharged by shore crane or ships' gear, to be picked up by straddle carrier and moved to storage, would be a saving in every way, irrespective of the method of stacking used. It is a method used in the Western Hemisphere, and between New Zealand and Australia. Why must single piece stowage still persist in the Scandinavian trade?

If such archaic methods must continue, then there is scope for the conveyor manufacturers. Timber handling has been suggested to some of them and to some importers on more than one occasion, but without any noticeable result. It does appear, however, that those who are most vociferous on the subject of the value of conveyors, are also those who find objections to every type suggested to them on one ground or another—and that includes manufacturers and importers alike.

The answer to the problems facing the timber trade in the U.K. lies in its own hands; the Timber Trade Federation of the U.K. is strong enough to gently but firmly get what it requires from the producers, thus enabling costs to be cut all round. Half the handling difficulties would then disappear, and the remainder could be solved with the co-operation of those whose work it is to find the answer to such problems.

Conditions at Port of Colombo.

With reference to the Gratiaen Report on the Port of Colombo, a summary of which was given in last month's issue of "The Dock and Harbour Authority," it is now known that the Port Commissioner for Colombo, Mr. Chandrasoma, is in complete agreement with the recommendations embodied in that report. He recommends that the proposed port trust be set up without delay and steps be taken to establish an adjudicating tribunal for wages, hours of work and conditions.

It has recently been announced that Mr. Edgar A. Lewis, late of the Port of London Authority, has been appointed by the I.L.O. as a port productivity expert to the port of Colombo, under the U.N. technical assistance programme.

The Grouting of Stone Pitched Sea Walls

War Department Trials at Shoeburyness

Trials have recently been carried out by the Royal Engineers, Shoeburyness, on the grouting of stone pitched sea walls by a process which, although widely used in Holland, has not previously been tried in the United Kingdom. This process consists of grouting with a cold bitumen cement sand mix, using a stable emulsion, accelerated by the use of special chemical additives (accelerator).

Owing to high import costs, it was not practicable to use a Dutch emulsion. As a result of research on emulsions manufactured in the United Kingdom, one found satisfactory for use with the additives was emulsion 1185, manufactured by Dussek Bitumen and Taroleum, Ltd. The originators of this process were Messrs. Smid & Hollander and Soil Engineering & Contracting Co. Ltd., their United Kingdom agents, undertook the necessary arrangements, the work being carried out under the supervision of Messrs. Smid & Hollander's representative.

The trials were carried out as follows:—

1. The bituminous grouting of random stone fill at the toe of a sea wall. The specification used for this was a mix consisting of 39 per cent. gravel ¾-in.—3/16-in., 39 per cent. sand, 6 per cent. cement, 16 per cent. emulsion, plus accelerator.
2. The grouting of hand-packed pitching both below and above the mean high water mark. For this, two specifications were used:—
   (a) Below the high water mark, the mix consisted of 72 per cent. sand, 7 per cent. R.H. cement, 21 per cent. emulsion and accelerator.
   (b) Above the high water mark, 77 per cent. sand, 6 per cent. cement and 17 per cent. emulsion and accelerator.
3. The third trial consisted of using the specification (a) above as a grout for filling joints between the "Essex" type of concrete blocks and, also, sealing cracks in an old concrete sea wall.

Technique.

A concrete mixer was used for preparing the grout. First, sand gravel and cement were fed into the mixer and, after a few revolutions, enough water was added to obtain the fluidity of mix to give the penetration required. The mixture of accelerator and emulsion was then added and thoroughly mixed until the contents were homogeneous. Care had to be taken to ensure that the mixing time did not go beyond this point, as lengthy mixing appears to accelerate the setting of the grout. The amount of water to be added was also carefully judged as allowance had to be made for the moisture content of the sand and gravel and the percentage of emulsion used. The grout was then run down a shoot lying on the sea wall, and brushed into a pitching or random fill with brooms. Where the grout was used as a mortar between concrete blocks, it was again brushed into position by brooms or trowelled in by hand. On these trials, it was found that the required fluidity on steep slopes was critical and that for an inexperienced team, it was easier to trowel in by hand.

The advantages claimed for this process are:—

(i) the grout is unaffected by tides flowing over newly completed work;

(ii) good adhesion is obtained between stone and grout, one reason for this being perhaps that the mix is cold and therefore does not contract on settling;

(iii) it is economical in labour and plant; no heating of bitumen and sand required;

(iv) the grout can be poured and sets satisfactorily under water without undue loss of material. It has been used many times for this purpose in Holland to close breaches in dykes. In such cases, random fill was poured into the breach and then grouted to a depth of 3—4-ft. below water level with very satisfactory results.

The trials at Shoeburyness already indicate that the performance of this grout substantiates claims i to iii listed above. A further trial to test claim iv will be carried out shortly.

Inland Waterways in the United States

Steady Development and Increased Facilities

By Col. HUBERT S. MILLER

RIVERS and waterways have played an important part in the development of civilization. Man cannot live without water and until means of transporting it were available his activities were always close to some source of water supply. This applies to the life and growth of all nations as well as to small groups of individuals. The history of most nations started at the oceans and followed up the river lines which provided the most effective means of transportation to the interior. Although our scientists and our engineers have loosened our ties to the actual river bank the map of every nation shows the dominant effect of waterways.

Most of the world's cities are found on important waterways. The advent of the railroads, the development of highways, the coming of the airplane and the development of crosscountry pipelines have all extended our transportation systems but waterways retain certain basic and fundamental advantages.

These later modes of transportation came into being at dates which found the different nations in various stages of development and accordingly the relative influence has not been identical. Today it appears that all nations have the problem of determining which type of transportation can most efficiently fit into the various segments of the transportation system.

The purpose of this paper is to point out some of the major factors which have influenced waterway development in the United States and some of the more recent means of meeting the present situation in that country. Since the birth of the United States as a nation, the Federal Government has played a dominant part in the development of inland waterways. It is unique among nations that this Federal responsibility has been exercised through a military organisation, the Corps of Engineers of the United States Army. The reasons for this assignment lie deep in American tradition and circumstances which are not particularly pertinent to the present discussion.

The development of the United States, as in most other nations, began at the seacoast and followed the river upstream. The Atlantic seaboard is blessed with many rivers, large and small, which provide ready waterways inland. The greatest river of all, the Mississippi and its far-reaching tributaries, extends northward from the Gulf of Mexico throughout the heart of the continent. This waterway system led early explorers great distances inland, and for many years provided the principal routes of communication and transportation. Although a complex system of highways and railroads developed later, the tonnage of waterway commerce is still increasing year by year. Unlike the Atlantic and the Gulf coasts the Pacific shoreline presents few waterways entering the continent; in fact, only the Columbia River in the Pacific Northwest is of major importance as an inland waterway. The development of the Pacific coastal area came in an era of history dominated by the steam engine and the railroad, with the result that the railroads pushing westward met the growing coastal communities close to the sea. It is therefore not only due to the few waterways nature provided on the Pacific Coast, but also to the period of history in which this area developed that inland waterways have played a less important role.

Many of the major rivers of the United States have been improved in the lower reaches to carry ocean commerce to inland seaports. Among them are the Delaware River in Pennsylvania; the Mississippi River below Baton Rouge, Louisiana; San Jacinto River and Galveston Bay (Houston Ship Channel) below Houston, Texas; San Joaquin River and Suisun Bay below Stockton, California; and the Columbia River in the northwest. Important deep-draft channels have been cut to save distance between coastal ports. Prominent examples are the Cape Cod Canal and the Chesapeake and Delaware Canal, both on the eastern seaboard.

In discussing waterways in the United States, it is helpful to consider them in three separate categories of distinctly different characteristics. In the first category is the Intracoastal Canal system, or more truly, two systems. One is known as The Atlantic Intracoastal Waterway which closely parallels most of the Atlantic seaboard. The second, The Gulf-Intracoastal Waterway, parallels the Gulf Coast. Neither system penetrates the interior of the country and neither served in the initial development of the nation. Both developed somewhat later to provide a safe and economical route for water shipment without the hazard of open-sea travel. It is fortunate that the topography of the Atlantic and Gulf coasts is particularly favourable to this type of development.

A similar system would be impracticable on the Pacific Coast and none has ever been considered there. These intracoastal systems primarily serve the coastal areas but the Gulf Intracoastal Waterway is intimately connected with the vast Mississippi system.

The second category is the Great Lakes extending along the eastern half of the Northern border of the United States and through the St. Lawrence River in Canada. It is doubtful that this should be classified as an inland waterway, as it more closely resembles ocean transportation than river or canal traffic. With the completion of the present St. Lawrence project, ocean-going ships will have access to the heart of the Continent. In most U.S. reports this Great Lakes system is classified in a category of its own—neither inland or ocean—but it is included here to complete the picture. This Great Lakes System is connected by Canal to the upper end of the Mississippi system and by the New York Barge Canal to the Hudson River.

In the third category we can group all other inland navigable rivers and canals, although this is a loose generalisation. The type of river craft and the nature of the commerce for example, are much different on the great Mississippi river than on the New York State Barge Canal.

The above few observations will make it clear that there is no one standard solution to the inland waterway development in the United States. But only are the size and nature of the rivers extremely varied, but the natural resources and the industries which develop commerce are distributed unevenly over the continent. This has meant that each waterway has been developed to meet conditions in that area with the resulting three general categories mentioned.

There are too many navigation projects completed, under construction, or being planned to discuss in this paper. It is sufficient to say that the general interest in inland navigation is at a high level. Tonnages moved over nearly all waterways is on the increase. There remain in the United States few undeveloped waterways and those few are under study. One of the more important of these is given as typical of the foresight and long-range planning involved in such development.

The Trinity River rises in Northern Texas and flows through the large inland cities of Dallas and Fort Worth to the Gulf near Galveston. This is an area of occasional flood and with periods of drought. These two cities, some 550 river-miles from the Gulf of Mexico, have a total population of approximately a million and a quarter people and are in one of the most rapidly growing areas in the nation. This is one of the largest centres of population to be found in the world without water transportation. The comprehensive plan under study includes all uses of water: municipal, industrial and irrigation, as well as navigation, for the entire Trinity River Basin—an area of 17,635 square miles. This illustrates the present trend in water planning which is to include all water uses in entire basin areas in a comprehensive plan.

As to the actual navigation features themselves, it is believed that the present trend in equipment and cargo-handling facilities are of special significance in illustrating the place water transportation is finding in the United States.

The water movement of bulk commodities in large quantities has certain inherent advantages over other means of transportation,

Inland Waterways in the United States—continued

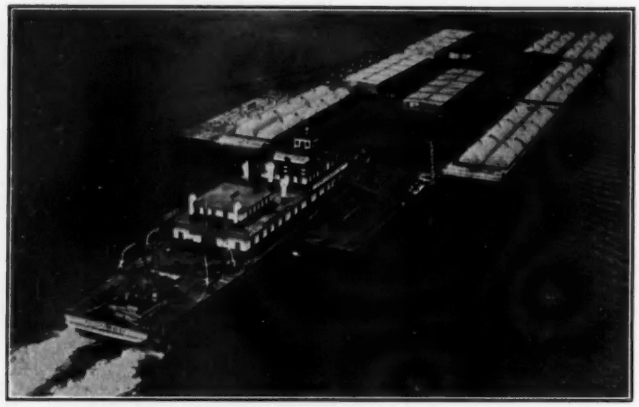


Fig. 1.

which are being capitalised on as the following examples will illustrate.

It is obvious from the three categories of waterways mentioned, that equipment is by no means interchangeable between waterways of a different water system. This further emphasises an increasing specialisation of equipment.

By far the greatest part of inland waterway traffic in the United States is carried in barge trains propelled by towboats. Conventional tows consisting of barges of various types assembled for pushing by either steam or diesel towboats are the most common.

Figure 1 shows an excellent example of a conventional tow. This is the motor vessel "Pioneer" downbound on the lower Mississippi River with a tow of 18 mixed barges: 8 of which are loaded with cotton and steel products; 9 are empty, and one is carrying fuel for the towboat. The "Pioneer" is a twin-screw diesel-driven vessel of 2,000 horsepower.

Figure 2 shows integrated tow with the Ashland Oil and Refining Company, Ashland, Kentucky, consisting of 8 barges and a diesel towboat used in transporting crude petroleum from lower Mississippi River ports to refineries on the Ohio River.

Figure 3 shows typical automobile carrier on the Ohio River. This Commercial Barge Line operation makes use of integrated unit barges (3-deck) on which 600 or more new automobiles are carried by river from such assembly points as Cincinnati, Ohio and Louisville, Kentucky, to Evansville, Indiana; Guntersville, Alabama; Memphis, Tennessee; St. Louis, Missouri; New Orleans, Louisiana and Houston, Texas from which distribution points they go direct to dealers.

This illustrates one of the many types of special-purpose barges being developed.

Figure 4 shows a barge constructed by the Dravo Corporation for the Consolidated Chemical Industries, Inc.; it is 175-ft. long by 30-ft. wide and has a capacity of 114,000 gallons in specially-lined cylindrical steel tanks running parallel the length of the hold. Each tank is 8.5-ft. in diameter and 135-ft. long. The tanks are sealed under pressure during voyages and the barges are decked over with steel to make the hold watertight. Two special pumps for discharging the acid are installed midway on the barge deck.

Fig. 3.

Figure 5 shows a barge designed for transporting lubricating oil blending stocks at elevated temperatures to maintain viscosity and facilitate unloading. The barges, built by Dravo Corporation for the Lake Tankers Corporation, are 240-ft. long and 40-ft. wide. Each has a capacity of 8,800 barrels at a loaded draft of 8.5-ft. Six cylindrical tanks, 16-ft. in diameter, are covered with 1.5-in. of mineral wool board insulation coated with a thick vinyl plastic and two coats of asphalt mastic. The cargo is loaded hot and its temperature is maintained by the insulation during transit. As an added precaution the barge is also equipped with steam coils for connection to shore steam if required before unloading.

Figure 6 illustrates a dry cargo barge designed for both narrow channel and open-water towing. It was built by Dravo Corporation of Wilmington, Delaware for "Time Magazine," Inc., Chicago, Illinois, to carry high grade coated printing papers from the State of Maine to Chicago over a 1,600-mile route. The barge is 211-ft. long by 42.9-ft. wide and has a cargo capacity of 2,000 net tons of paper, or 1,890 net tons of grain at a loaded draft of 10-ft. The barge has a V-shaped notch recessed in the stern to hold the tug's bow when the barge is being pushed in narrow channels. In open water along the coast and on the Great Lakes the barge is pulled on a line behind the tug. The barge is manned by a crew of three who live in a comfortable five-room deckhouse on the stern of the barge. Equipment includes two-way radio-telephone, electric bilge, ballast, and wash-down pumps.

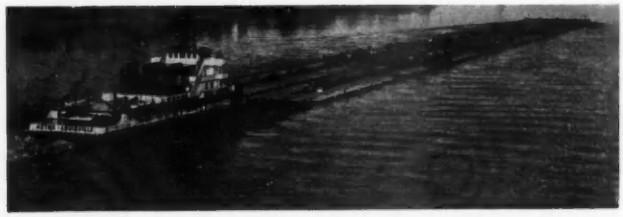


Fig. 2.

The keystone of economical inland waterway transportation in the United States is the modern towboat. It is designed for the service in which it will be operated and has special features for its particular purpose. The majority of modern towboats on the Mississippi-Ohio River System are diesel-powered twin-screw vessels fully controlled from the pilot house. They provide great power and manœuvrability required to handle long and heavy tows through locks, pools, and in river currents. It is usually triple-decked with the hull and deck constructed of welded steel plate over heavy steel framing. The bow deck overhangs the hull to provide ample room for safe handling of the heavy wire lines securing the tow. Propellers are usually of the broad tipped four-blade type fitted with Kort nozzles for maximum thrust at low towing speeds. A steering rudder is mounted directly behind each propeller and two backing of flanking rudders are mounted in front of the propeller. These rudder positions with respect to the nozzle allow interception of practically all of the flow from the propeller and thus insure development of maximum rudder power. The pilot house, which is the nerve centre of the entire operation, is spacious and many large windows provide excellent visibility. The front windows, extending the full width of the pilothouse, are sloped to avoid reflected glare. Steering is by levers which maintain the same angles as their associated rudders. Controls are mounted on a console within easy reach of the pilot. Towboats are equipped with radar and radio-telephone.

Towboats are designed and equipped to perform efficiently and with the greatest degree of safety and comfort to the crew. Typical of consideration for the workmen are the accommodations for eating, sleeping and relaxation. The galley and messroom are com-

Inland Waterways in the United States—continued

bined in the stern section of the main deck cabin. The galley is immaculate, and outstanding among its appointments are the large electric range, stainless steel sink, gleaming white refrigerator and cupboards, and the important double-burner coffee maker. Dining facilities provide comfortable seating for about eight men at a time. Ample lighting and adequate room in this area produce a warm homelike atmosphere contributing to the relaxation and pleasure of all personnel. The front of the cabin contains sleeping quarters for the crew, bath and toilet facilities, and a large lounge room. Sleeping quarters are double-bunk staterooms which are well heated and ventilated, and comfortably furnished with innerspring or foam rubber mattresses and provided with ample clothes closets and lockers.

While the foregoing provides a brief description of the typical modern towboat, the special equipment employed on several vessels deserves brief mention. Most recent towboats have Kort nozzles and Contraguide rudders to give greater propulsion efficiency and manœuvrability.

Figure 7 is an excellent illustration of this equipment which is operated by the John I. Hay Company of Chicago, Illinois. The nozzle can be defined as an annular-shaped ring with an airfoil cross section which surrounds the propeller. This steel ring is built into and forms part of the vessel's stern, and in encircling the propeller it controls the flow of water into, through and away from the propeller. The nozzle feeds the propeller with a large mass of water at higher velocity providing a bigger bite and thus more thrust and speed without any increase in horsepower. Vessels so equipped are more responsive to the rudders and have better manœuvrability. Vessels can be manœuvred sideways, which is a distinct help in negotiating sharp river bends. The contraguide rudder is a patented device which has been in use for a number of years on deep-water craft but is a relatively new development on inland waterway vessels. The rudder is one solid piece with

Fig. 5.

the upper and lower halves set slightly oblique to each other. This rudder converts the normally wasted rudder motion of the propeller discharge into a powerful thrust. This results in increased speed without increased horsepower, lower fuel consumption because of greater operating efficiency, and easier steering.

Figure 8 is another illustration of specialised equipment. This is the Ka-Me-Wa propeller with which the 3,200 h.p. towboat "Delta Cities" is equipped. The Ka-Me-Wa propeller is a controllable reversible pitch propeller which takes its name from its manufacturer, AB Karlstade Mekaniska Werkstad of Sweden. It has been in commercial use in Europe for a number of years, but the first installlation in the United States was made on the "Delta Cities" when it was constructed in 1952 by the St. Louis Shipbuilding Steel Company for the Lake Tankers Corporation. The two 108-in. diameter stainless steel Ka-Me-Wa propellers on the "Delta Cities" are controlled from the pilot house. The pitch is fully controllable and reversible permitting continuous operation of each main engine in one direction at a constant speed. Pitch control is especially advantageous for towboats operating on the inland waterways, since it permits efficient use of full engine power under widely varying operating conditions. Loaded or empty barges, the number of barges in a tow, and deep or shallow water in which the boat is operating all impose variable loads on conventional towboat engines. With the Ka-Me-Wa controllable pitch propeller, the towboat's engines develop full r.p.m. and horsepower under these varying conditions.

Fig. 4.

Figure 9 A revolutionary development in towboat propulsion has been installed on an experimental vessel which is being tested by the Army's Transportation Corps Research and Development Command. This is the "sinusoidal vertical axis propeller" which consists of two assemblies at the stern of the vessel. Each propeller assembly consists of an arrangement of vertical blades, with controllable pitch, projecting downward from a rotating disc at the base of the unit. The propellers measure over 11-ft. in diameter. Each of the six manganese bronze blades attached to one disc is 4.5-ft. long. Each assembly fits into a circular opening in the stern of the towboat and is readily accessible from the stern deck for repair and maintenance. Blades can be replaced without drydocking the boat. Shafts from the main engines are connected to the rudders through double reduction gears built into the propeller assembly. With this type of propeller there is no need for rudders, such as used on conventional screw-type propeller boats. This boat is operated from the pilot house approximately the same way as any towboat. However, two steering wheels are used instead of the usual four rudder levers. Variations in thrust are obtained by adjusting the engine speed while propeller blades are automatically pitched for maximum efficiency. Each blade is connected by a rod to an eccentric ring around the rotor shaft. Movement of the ring changes the pitch of all six blades. For steering and flanking, the entire eccentric ring assembly is turned to alter the direction of thrust. The propellers can deliver thrust in any direction of a 300-degree circle, thus providing exceptional manœuvrability to the vessel.

Figure 10 shows the steamer "George M. Humphrey" constructed by the American Shipbuilding Company of Lorain, Ohio, for the National Steel Corporation and operated by M. A. Hanna Company of Cleveland, Ohio. The vessel is the newest addition to the Great Lakes ore fleet, the largest ever built for service on the Great Lakes and is reported to be the most advanced in the design

Fig. 6.

Inland Waterways in the United States—continued

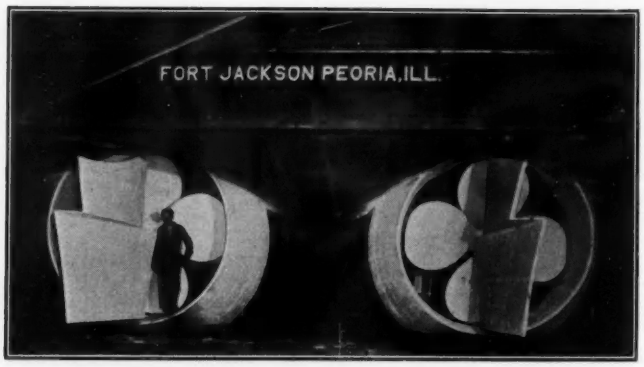


Fig. 7.

of both hull and machinery. It is 710-ft. long with a 75-ft. beam and has a cargo capacity of 24,000 gross tons at 25-ft. 6-in. draft. Total fresh water displacement is 32,210 gross tons. A fuel oil burning steam power plant provides 8,500 shaft horsepower to a single five-bladed wheel having a diameter of 19-ft. 6-in. The vessel is capable of speed of 16½ statute miles per hour loaded, or 17½ miles per hour light. Nineteen hatches are provided, which are 17-ft. fore and aft by 54-ft. across. The electro-hydraulic hatch crane used for handling the 12-ton hatch covers may be seen in the picture. The general arrangement of the ship is similar to all Lake vessels, and it is found to be the most efficient for handling cargo to and out of the holds and for navigating the restricted and congested channels. The boiler and engine rooms are located aft, cargo holds in midship, and the pilot house in the bow. The "Humphrey" carries a crew of 41.

Another unique class of Great Lakes vessels (not pictured here) is the self-unloading steamer "Alpena," operated by the Wyandotte Transportation Company. The "Alpena" has a length of 375-ft., a beam of 47-ft. and a capacity of 3,600 tons. The length of the boom is 95-ft. Self-unloader vessels are used principally for carrying limestone, coal or cement. Beneath the cargo space of each vessel are continuous belt conveyors which extend the length of the ship. After limestone, for instance, is released through openings in the bottom of the hold the conveyors carry it to a bucket elevator in the bow. The elevator hoists the stone to a continuous belt conveyor in a boom overhanging the deck. The boom reaches out from the bow and can swing in a wide arc to unload the stone over a large area of dock space. While the "Alpena" is typical of the self-unloaders, many larger vessels of this type are in operation. For example, the steamer "John G. Munson" (not shown), which was constructed by the Manitowoc Shipbuilding Company of Manitow, Wisconsin, in 1952 for the Bradley Transportation Company of Detroit, Michigan, is 666-ft. long and has a beam of 72-ft. The "Munson" has a cargo capacity of 20,000 gross tons which can be unloaded in about 4½ hours at a rate of about 5,000 gross tons per hour.

Figure 11 shows an automobile carrier on the Great Lakes owned by the T. J. McCarthy Shipping Company.

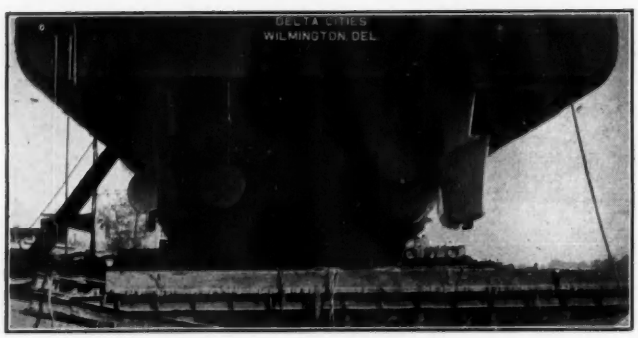


Fig. 8.

Essential to the success of inland waterway commerce are the efficient terminals which have been provided for loading or unloading commodities. Fig. 20 shows the general layout of a complete river-rail-truck terminal with warehouse facilities at Evansville, Indiana, on the Ohio River. It serves all rail lines entering Evensville, numerous truck lines, and the barge lines operating on the Ohio River. The waterside facility consists of a 110-ft. by 285-ft terminal building which extends out over the water so that barges may be loaded or unloaded while under cover. Two 10-ton

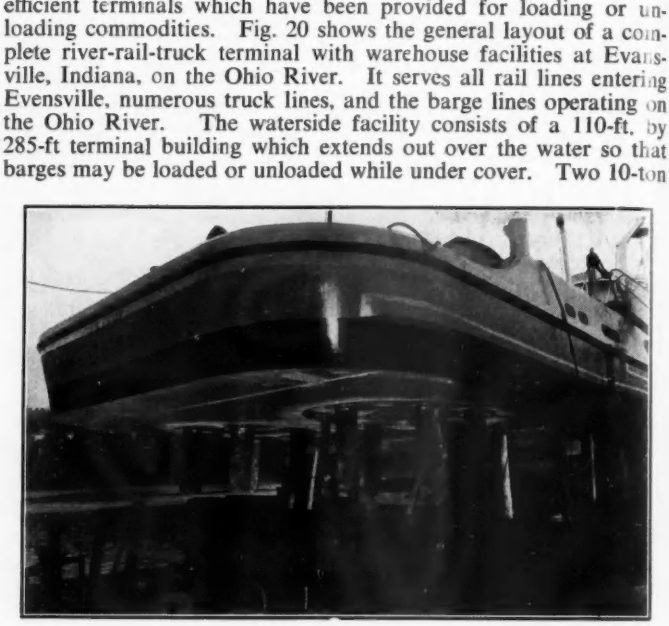


Fig. 9.

high-speed electric overhead bridge cranes are available to facilitate cargo handling. Alongside the terminal building are facilities for unloading bulk materials. A warehouse built of brick, steel and concrete has 100,000 square feet of storage space all on one floor. A rail siding with capacity for 14 cars extends along a 650-ft. dock under a canopy. There are also 20 truck docks along a 650-ft. canopy-covered platform. Where possible all traffic is handled on pallets by fork trucks. Goods are also stored where possible on pallets. If pallets cannot be used, skid platforms, conveyors, and mechanical stackers are employed.

Figure 12 shows another example of an integrated river-rail-truck terminal. This is the McKees Rocks Terminal on the Ohio River 3½ miles below Pittsburgh, Pennsylvania. This facility, said to be one of the most spacious of its kind in the United States, covers a 103-acre site. It is expected to afford new and more economical shipping and distributing methods for hundreds of industries by providing facilities for the shipment of raw materials and finished goods into and out of the Pittsburgh area by waterway. It will serve as a terminal for barges, railroad cars, and trucks. Included in the facilities of this terminal are almost ½ mile

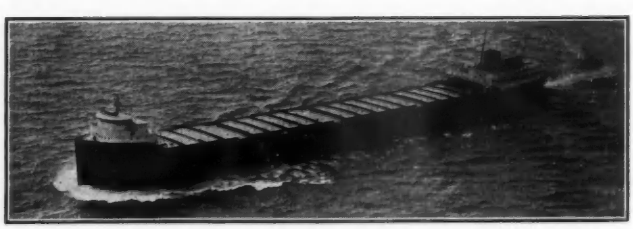


Fig. 10.

of Ohio River frontage; 1,800,000 square feet of covered storage space; 40,000 square feet of office space; 30 acres of open storage area served by cranes and railroad siding; 13½ miles of railroad tracks and a complete terminal railroad; equipment that can load and unload barges with maximum 60-ton lifts; unlimited, uncongested parking facilities for trucks; complete watchman and fire protection service; and a full complement of materials handling equipment, including cranes and lift trucks.

This is a brief review of the inland waterways system in the

Inland Waterways in the United States—continued

United States—a system which is increasing steadily. In 1955 this traffic amounted to over 216 billion ton-miles of freight as compared with 173 billion ton-miles in 1954. The railroad network is excellent and, of course, vital and indispensable. The highway system is in a phase of great expansion and improvement with each year showing increased quantities of freight and passenger movement. In recent years the rapid expansion of pipelines for the transportation of petroleum and other commodities has altered the transportation pattern materially in some areas. The constantly growing use of the airplane has cut heavily into the rail passenger traffic. For many years there has been little use of the waterways for passenger movement.

The changes continue—seemingly always at an increasing rate. Changing economic factors, such as the substitution of gas and oil for fuel in place of coal, has had an important effect on transportation. The rapid development of new industries in new locations,

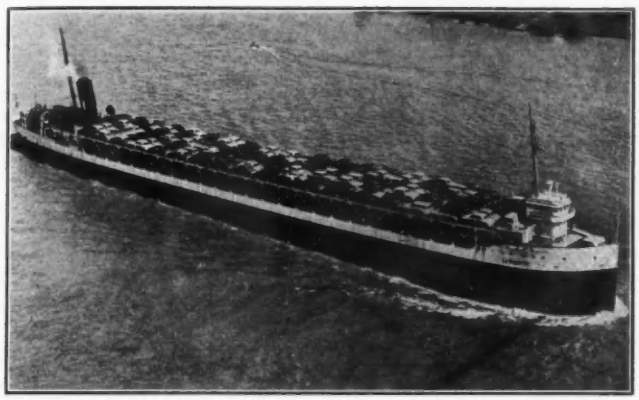


Fig. 11.

Fig. 12.

the creation of new agricultural areas by irrigation, the development of new mines or the playing out of old ones, all contribute to altering the traffic pattern. In the midst of all these changes, the old reliable waterways are not only holding their own but are receiving greater emphasis.

Certainly the reasons for this increased interest are complex, but it has been the intent of this paper to point out at least one of the reasons. This is the development of specially designed bulk carriers and special handling devices in order to capitalise on the particular advantage the waterways have over other means of transportation in the movement of bulk commodities. This may be of less relative importance in other parts of the world but it appears to be a very important factor in the United States in solving the problem of fitting water transportation into the overall traffic system where it can serve most efficiently.

Liverpool Steam Ship Owners' Report

Port Congestion and Suggested Remedies

The annual report of the Liverpool Steam Ship Owners' Association deals at some length with the conditions within the port and the campaign it has been conducting to speed up the clearance of import cargoes from the quays and thereby relieve congestion, and to facilitate the quicker turn-round of ships.

With a membership of 67, representing nearly 4,800,000 tons gross of liners based on Liverpool, the Association has as its chairman Mr. J. H. Joyce, of the Elder Dempster Line, and Sir Harold A. Bibby, of the Bibby Line, as vice-chairman.

The campaign to which the report refers has been in the hands of the special committee the Association appointed in 1955. In the last report, the findings were published of the investigation this committee made into the causes of the congestion from which the port had been suffering. The over-riding factor was found to be failure on the part of receivers to clear their goods timeously and misuse of quay space as temporary warehousing accommodation and for purposes of marketing, sampling and similar operations. That, it was said, was the major cause of the slow turn-round of ships engaged in the trade of the port. Over the short period of four months which the investigation covered it was found that, in the case of the 165 ships examined, time equivalent to 600 days had been expended in discharging operations over and above that which, given normal expedition, would have been occupied.

Keeping Up Pressure.

The committee has kept up pressure to ensure that receivers guilty of these practices of delay were adequately penalised. It has recently received renewed assurances from the Mersey Docks and Harbour Board that penalty rents are being stringently imposed where deserved and that compulsory warehousing is being applied and, indeed, intensified. Transfer into warehouse of goods from the quay at the expense of their owners is the ultimate remedy for wrongful delay in their removal. The Board's powers are adequate for the purpose and warehouse space is not lacking. The Association looks to the Board to exercise its powers whenever occasion demands. It has been glad to find that, in calling for stringent measures of this kind, it has the support of the Liverpool Chamber of Commerce.

In October last a meeting was held at the instance of the Chamber at which representatives were also present from the Board, H.M. Customs, the Chambers of Commerce of Birkenhead, Bootle, Runcorn, and Widnes, the Master Porters and Master Stevedores Association, the Institute of Shipping and Forwarding Agents, the commodity trade associations of Liverpool, the rail and haulage interests and others. In the minutes of that meeting, agreement is recorded that " more drastic action by the Mersey Docks and Harbour Board in the imposition of penalty rents and the issue of orders for the removal of goods from the quay would result in greater availability of goods for consignees wishing to remove them at the earliest opportunity." Thus, says the report, the traders are found complaining that the malpractices of a minority hamper the majority in getting expeditious receipt of their goods; the shipowners complain that the valuable time of their ships is being wasted; the Board therefore has ample support and encouragement for increasingly drastic measures.

Customs Clearance.

The collector of Customs, with whom the committee had had talks earlier in the year about Customs formalities as a possible contributory cause of delay in clearance, was present at this meeting and undertook that, if necessary, he would sympathetically consider any application for an increase in the number of bonded warehouses but, he said, the greater part of the problem seemed to arise in respect of goods which had had Customs' clearance and were left on the quay awaiting disposal instructions. Warehouse space was amply available for such goods, but the voluntary use of it was not increasing. Another proposition concerning cargo operation considered by the Association's committee was that dis-

Liverpool Steam Ship Owners' Report—continued

charging berths should be appropriated to individual master porters by way of lease from the Board. There were divided views about this and the general purposes committee decided that a sufficient measure of support was lacking to justify its further pursuit.

Delivery by Road Transport.

The Association has also examined the delivery at the docks by road transport of export merchandise. In December the Association was represented at a meeting called by the Liverpool Chamber of Commerce to consider points which the organisations representing the road hauliers thought could be the subject of useful discussion. These included an improved road traffic control system, separate "queues" for goods requiring cranage and goods unloaded by hand, the difficulty of dealing with small packages in one vehicle for more than one ship, a practice condemned in the report of the Ministry of Transport Port Efficiency Committee. It was not thought practicable to give preference to vehicles containing small packages, and it was suggested that there ought to be a depot outside the dock area, as in London, to act as a collecting house for small packages, to be organised by the road interests.

Need for Staggering.

The road hauliers also urged that the system of calling forward cargoes at present in vogue caused an undue rush of work towards the closing days of loading vessels. The Association's representatives confirmed that the shipping companies constantly found that the greater part of the cargo for a ship came down in the latter part of the period instead of being staggered over the whole. They would be only too glad to find some solution, but it seemed it could only come by continual exhortations to shippers. The Chamber of Commerce could undoubtedly help by educating their constituents and so could the road hauliers, who were in direct contact with the shippers and could point out the delays and consequential expense involved.

A further criticism of the road hauliers was that in some respects there was a shortage of cranes capable of dealing with packages of up to two tons, although the Association's information was to the contrary. It was pointed out that many drivers were unaware of the fact that in Liverpool the custom of the ports is that the duty lies on those in charge of the vehicle to unload it. The shipping companies provide assistance, but do so voluntarily and without charge. Appropriate stowage of vehicles and the possession of a stowage plan were also urged.

Allocation of Berths.

The hope was expressed that an improvement in the allocation of berths could be effected to prevent the physical clashing of import and export traffic. While there was general agreement on this point it was realised there is little opportunity, while the port is as busy as it is, of anything being done.

The report sums up the results of this meeting by saying that it served a useful purpose and on the principal point raised, that of better "staggering" of road deliveries over a ship's loading period, the Association hopes for the much-required improvement. The practice of shippers to concentrate on the last days of the receiving period is no doubt in part due to pressure under which they themselves are working, but, it may be suspected, is also partly due to the human tendency to leave things to the last. "Those who follow it should be made to realise that it is one involving needless expense to themselves."

Princes Landing Stage.

The Association's landing stage committee has continued to seek ways in which the present facilities at the Princes Landing Stage could be improved and additional amenities made available to meet the needs of the large volume of passenger traffic using the stage. Meetings with the Board have been held, some progress has been made and further consultations are taking place.

Railway Wagon Demurrage.

This relates to claims by the railways on liner companies for alleged demurrage on railway wagons consigned to the ports with export merchandise. Liability, which is disputed, was claimed to arise on a Statutory Order made at the outbreak of war in 1939. Since then, and particularly in the post-war period, it has brought increasing argument and dispute in its train. Further discussions with the Railways Division took place during the year and, with the authority of the liner panels, a proposition for the disposal of disputed accounts was made and accepted. It was with regret that the Association was given to understand that, although something was in the planning stage, the Railways Division was still unable to discuss future arrangements.

In the Association's belief, the root of all these troubles, during a period which now extends to ten years, is that the railway authorities will insist on dealing with the matter centrally from London, and on trying to lay down a centralised system for all the ports involved, despite the high degree of variation in local conditions as between one port and another. "If the Railways Division would only decentralise it and give the interests concerned in each individual port a chance to agree on arrangements suitable to local needs, the Association believes that it could all quite quickly be put on a sensible footing. It is certainly confident that that would be the outcome in the port of Liverpool."

Wreck Removal.

The Association has had discussions with the Mersey Docks and Harbour Board on one of the smaller issues of the limit of liability convention, "but one on which break down in international uniformity should not be permitted." Most of the port authorities of the United Kingdom can, under their private Acts of Parliament or otherwise, look to the shipowner for reimbursement in full of wreck removal expenses. Liverpool is an exception to the general rule, since, under the relevant private Act applicable to the Mersey Docks and Harbour Board, the shipowner has the benefit, in relation to a claim for wreck removal expenses, of the right of limitation of liability which, in other respects, is given him by the Merchant Shipping Acts.

On the Continent and in the United States the position is understood to be on much the same basis as it is in Liverpool. The new convention follows the Continental system and brings wreck removal claims within the ambit of limitation. In all earlier attempts to produce uniformity in this branch of maritime law, the port authorities in this country have opposed any change which would be to the prejudice of their existing rights. The aim of the present discussions is to obtain agreement on this issue so that the convention, if it comes up for adoption as a whole by the United Kingdom, is not rejected in this respect, with the consequential break in uniformity which rejection would entail and to the detriment of the principle, which surely is the right one, that international agreements of this kind should not be subjected to unilateral partial rejection.

On the part of the shipowners, it is not denied that in some suitable way the port authorities must be reimbursed expenses of this kind incurred by them, or that the burden of reimbursement should not fall on the ships using the port. The need is to find a fair method, by insurance or otherwise, of reimbursement which does not involve a partial rejection by the United Kingdom of the international convention. Given general good will towards the attainment of that end, an acceptable road to it should certainly not be incapable of being found.

Port Developments in Pakistan.

The Pakistan Minister of Communications has announced that about Rs.125 mn. is to be spent on the reconstruction and modernisation of the east wharf berths at the Port of Karachi. The project is expected to be completed in 1961 and is designed to improve the handling capacity of the port by 35 per cent. Extension of the bulk oil pier is now nearing completion and when finished will provide a berth for another tanker. As well as reconstruction there are also plans in hand to improve the port's cargo handling facilities and nearly Rs.30 mn. has been allocated for this task.

In Chittagong seven new jetties have been constructed and 29 three-ton electric cranes and five transit sheds have been provided. The port now has accommodation for 24 ships.

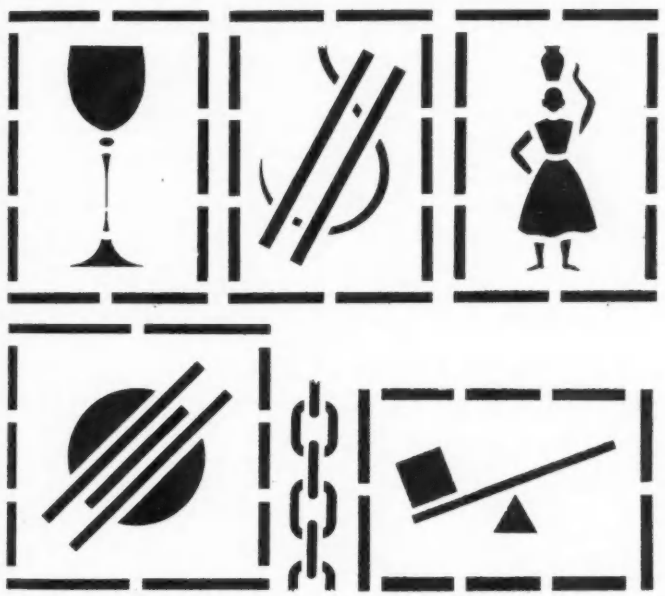
The Chalna anchorage has been developed to relieve congestion in Chittagong and three additional moorings have been laid in recent years, bringing the total up to nine.

Progress with the B.S. Pictorial Handling Marks

Good packaging is now an accepted part of almost any export programme. Equally important is the art of good handling. However good the product and however strong the package, bad handling may result in damaged goods and consequent dissatisfaction at the receiving end.

It was to reduce the chance of damage to goods in transit that (as reported in our September, 1956, issue) the British Standards Institution published last August its recommendations for simple handling instructions in picture form (B.S. 2770). In the six months which have passed there have been encouraging signs that the six recommended marks (illustrated on this page) have been favourably received in the world of commerce.

At least one firm is producing, on a commercial scale, stencils of the six marks. Several manufacturers ranging from the aircraft to refrigeration fields are using these stencils to stamp on to their cases and packages wefore despatch to home or overseas buyers. Some trade associations are at present considering whether to recommend to their member firms the widespread use of the British Standard marks on all goods destined for shipment abroad.



(Top left). Fragile. Handle with care.
(Top centre). Use no hooks. Do not puncture.
(Top right). This way up.
(Bottom left). Keep cool. Stow away from boilers.
(Bottom centre). Sling here.
(Bottom right). Heavy weight this end.

The real success of this British Standard lies, however, in the eventual adoption of the six marks by all trading countries. If a British package is to be safely handled between Liverpool and Lagos or Southampton and San Francisco, it is obviously essential that dock and railway workers in all parts of the world should instantly know that, for example, the "girl-with-the-pitcher" symbol indicates the right way up of a package.

From South Africa and India comes encouraging news that the national standards bodies in these countries are recommending to their own manufacturers and transport organisations the use of standard marks similar to the British ones.

On the wider international level the International Organisation for Standardisation (which seeks to co-ordinate the various national standards) is at present considering, at B.S.I.'s request, the question of giving the British handling marks full international status.

Pictorial marking is, of course, not new. As long ago as 1924 the International Union of Railways recommended pictorial labels for the marking of dangerous goods to be carried by rail. Other national and international organisations have been using pictorial marks to indicate certain risks for an even greater length of time. With dangerous goods such marks are often the subject of statutory regulations; with non-dangerous goods no such regulations apply and many users have evolved their own systems—consequently a good deal of confusion has resulted.

British Standard 2770 seeks to clear this confusion. It is something of a compromise, combining in its recommendations some old symbols which have become well-known through long usage, and introducing new ones.

Whether these marks will, in fact, become the standard "language" of the trading world depends largely on the education of all concerned with cargo-handling. To this end the benefits to be derived from dock and harbour authorities in teaching labourers the meaning of the standard symbols cannot be over-emphasised.

Grabbing Cranes for Dagenham Dock

High Output Rates for Bulk Cargoes

Dagenham Dock, which is owned and operated by Samuel Williams and Sons Ltd., has a frontage of three-quarters of a mile on the north bank of the Thames, and is equipped with efficient bulk handling appliances.

Electric cranes of the transporter type were constructed and installed upon a reinforced concrete jetty as long ago as 1901. In 1937 their No. 7 jetty was built and equipped with three Stothert and Pitt grabbing cranes for the discharge of colliers either overside, into barge, or into the hopper of a coal screening plant.

Some details of these cranes are of interest as the installation is by no means out of date by contemporary standards, and forms a basis of comparison for the later developments.

The cranes were orthodox machines of 7½-ton capacity with a hoisting speed of 200-ft. per minute, a luffing speed of 130-ft. per minute average, and a slewing speed of 1¼ revolutions per minute. They were powered by wound rotor A.C. motors with plain rotor control on all motions and no form of electrical braking. The brake drums for the mechanical brakes on the hoist motion ran at a motor speed, namely 730 r.p.m., one drum being used for a foot brake only, the other brake being electrically operated by a B.T.H. thruster. A standard product, of simple and rugged design, these cranes have given nearly twenty years of exemplary service.

Since the Second World War the traffic on this jetty has increased steadily and three more cranes of similar type but with a hoisting speed of 250-ft. per minute and with counter-current braking on the hoist motion have been supplied. The increase in speed and braking duty necessitated the use of 200 h.p. hoist motors, an increase of 50 h.p. over the earlier equipments.

Although the mechanical gear on these cranes was virtually a duplicate of the earlier ones, the electrical gear was of modern variety, and joy-stick controllers were supplied for all motions except travel.

Before ordering the new cranes considerable thought was given to the merits of various machines of different types. The pros and cons of cranes having a very high performance and high capital cost were weighed against those of cranes having a higher load lifting capacity and normal performance. The advantages of a large number of smaller cranes with standard performance were also considered against those of the high performance crane. However, on the score of the interchangeability of the grabs, it was agreed that it would be unwise to add to the existing equipment cranes of a different capacity and the problem sorted itself, therefore, into high performance versus orthodox equipments.

General Details.

The new cranes were built explicitly for the requirements of operation at Dagenham Dock where grabbing of bulk cargoes at high output rates is the primary duty. A number of features may well prove to have some application in other installations.

The cranes are 7½-ton rated capacity for grabbing duty at 85-ft. maximum radius, with a minimum radius of 25-ft., and a tail radius of 17-ft. 9-in. They have a total range of lift of 80-ft. plus the necessary grab pull-out of 23-ft. They were specified to be capable of a duty cycle of about 28 seconds when working from ship

Grabbing Cranes for Dagenham Dock—continued

to barge laying outboard, with a lift for this cycle of 30-ft. An alternative cycle when slewing through 150° was also specified with a time of 36 seconds when working into a hopper. To achieve these cycles it was at first considered necessary to have a hoisting speed of 300-ft. per minute and a lowering speed of 400-ft. per minute, but it has been found possible to increase both these speeds to about 450-ft. per minute without loss of control and obtain still better cycle times. Particular attention has been paid to the rate of acceleration and deceleration of the hoisting gears, both by a specialised control system supplied by The British Electric Company Ltd., and by the reduction of inertia to a minimum. An indication of the success achieved in this direction can be obtained by the fact that it is possible to accelerate to 80 per cent. hoisting speed in one second and to change from full speed lowering to 80 per cent. hoisting speed in a little over two seconds with full load on the crane.

The slewing and luffing speeds were selected to suit the most frequently used working cycles, and are respectively 1½ r.p.m. and 175-ft. per minute average. Both these motions have a conventional A.C. drive, similar to the original cranes, but with contact or control gear operated by a combined miniature joy-stick master controller.

Experience with the earlier cranes which had the triple reeving common to most Stothert and Pitt crane designs suggested that a worthwhile saving in rope costs might be obtained over the life of these particular cranes by sacrificing accurate level luffing and using a single part reeving over a high apex to give approximate level luffing. This system shortens the closing and holding ropes.

Power for Hoisting Motions.

It was originally felt that an A.C. motor having an exceptionally high torque and a long small diameter rotor might meet the requirements for the hoisting motions, but although enquiries were sent to a number of motor manufacturers, little progress was made in view of the inherently high Wr^2 even for this type of machine. The relative difficulty in providing an effective counter current braking system which was fully controllable was also against this arrangement. Both plain counter current braking by plugging and braking by D.C. injection were considered at this stage.

High duty 7½ ton grabbing cranes at Dagenham Dock.

Driver's cab in one of the 7½ ton cranes, showing the wide view obtainable.

The alternative of a D.C. drive was next investigated and it was imediately apparent that the Wr^2 of a D.C. machine of comparable output could be very much less than that of an A.C. motor. The relative merits of Ward-Leonard versus mercury-arc rectifiers and even Ignitrons were checked. The Ward-Leonard system had most points in its favour if it could be effectively controlled against excess current when the driver moved the controller too rapidly. Accordingly a form of Ward-Leonard was designed and supplied by the English Electric Company Ltd., in which field forcing is applied to the generator by magnetic amplifiers, the control of which is taken from a potentiometer operated by the hoist controller. The potential acceleration and deceleration torques with this system are only limited by the characteristics of the motor and generator and the amplification of the magnetic amplifier. The normal drawback of a balanced grab system, namely, reduced acceleration during grab opening, therefore, no longer obtains. Full use has been made of this advantage, and about half the weight of the grab contents as well as the weight of the grab have been balanced off. This has reduced the cost and has enabled a smaller horse power hoist motor to be used. It is anticipated that the cost of electrical consumption will be reduced by about £700 per crane per year on the basis of present crane loading cycles when compared with the existing cranes.

The English Electric D.C. hoist motor is of the steel works auxiliary type, having a robust fabricated frame, and an armature of low inertia. The nominal rating of the machine is 100 h.p., at 485 r.p.m., 230 volts, but a speed of 725 r.p.m. has been achieved by raising the armature voltage to 340.

The motor generator set which supplies variable voltage D.C. power for the hoist motor comprises a 125 h.p., 981 r.p.m. squirrel cage induction motor, driving an 83 kw. D.C. generator and a 6 kw. 220 volt level compound wound exciter. All machines on the M.G. set are naturally ventilated. They are housed in an upstairs compartment in the machinery house with the electric control gear. The dynamic balance of the equipment is excellent and no vibration and very little noise can be detected in the driver's cab when the intercommunicating windows between the cab and the machinery house are closed.

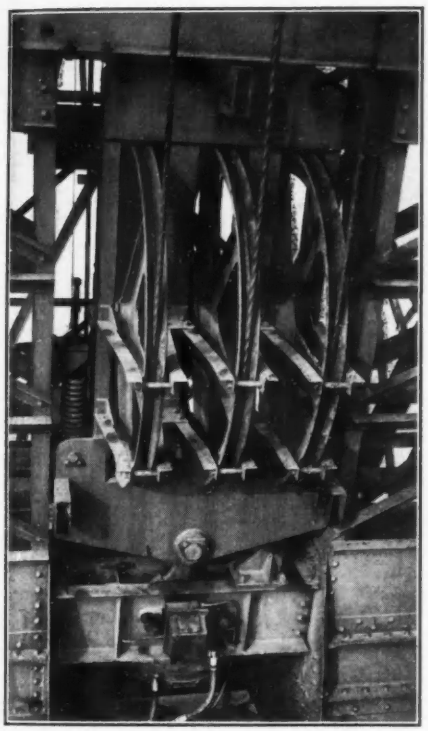
The mechanical hoisting gear is of conventional two-barrel type with a coil clutch and hold brake both being thruster operated under the control of a switch incorporated in the hoist master controller. In view of the very high speed of operation, and the large diameter barrels (4-ft.) it has been considered advisable to incorporate a device which prevents the clutch from being engaged when the hold barrel is at a standstill and the closing barrel running at full speed.

The layout of the driver's cab has received considerable atten-

Grabbing Cranes for Dagenham Dock—continued

tion, and the help of B.I.S.R.A. was enlisted in view of their experience in steelworks with similar problems. To the right of the driver, who is seated, is an Allen West M.C. type miniature master controller, the handle being moved towards him for hoisting, and away for lowering. A slight sideways movement of the handle disengages the hold barrel from the closing barrel and enables hoisting and lowering movements to be converted to closing and opening movements respectively. To the left of the driver is a joy-stick Allen West M.C. controller, operating on slew and luff, the movement of the handle coinciding with the path of the grab.

On occasions the cranes have to handle general cargo, during which time the grabs are removed. As the requirements for cargo duty include creep speeds in both hoisting and lowering directions, in spite of large variations in load, a changeover switch has been fitted under the control of the driver. This switch enables him to select one or two hoisting conditions, namely cargo or grabbing duty.



Front view of weighing sheaves showing load balancing unit for weighing machine at bottom of illustration.

To the left of the driver is a foot operated switch which frees the hold barrel brake when the clutch is disengaged and allows the grab to sink into the material when digging without free hold rope being paid out in advance. The switch is only operative when the hoist controller is in the "Open/Close" position.

Visibility from the driver's cab is very good. Forward and sideways vision is through large safety glass windows and in order to assist downward vision, the floor has been cut away by the driver's feet and an inclined armour plate glass panel inserted in the floor. The cab is electrically heated with thermostatically-controlled convectors, heat insulation being provided in the ceiling and the walls.

The general shape of the crane's superstructure was dictated by the desire to use the fewest possible reevings on the counter balance weight ropes, and so enhance rope life. The arrangment adopted has a twin rope connection between the hoist barrel and the counterbalance weight with three reevings at the weight. The hoist barrel is extended to take the counterbalance ropes.

Automatic Weighers.

The cranes incorporate Williams Recording Weighers developed and marketed by Samuel Williams and Sons Ltd. This machine automatically prints on a paper strip the totalised net weights discharged from the grab. Automatic compensation is incorporated in the equipment to allow for the variations in the weights of the ropes with hoisting and to deduct the tare weight of the grab. The only operation performed by the driver to obtain a weighing is to press a button. This locks the crane out for four seconds, which is long enough for the grab and the crane to stabilise. Immediately after the weighing takes place the crane is re-energised for work. The weighing equipment is in the driver's cab and no weighman is required.

The hydraulic Load Balancing Unit of the weighing machine and a set of weighing sheaves, taking all three ropes (one holding and two closing) is assembled in the superstructure immediately over the machinery house roof. A further set of three sheaves, mounted on a pivotting beam assembly above the weighing sheaves, takes the ropes from the weighing sheaves to the hoisting drum. This assembly equalises the loads in the two closing ropes up to comparatively large angles of tilt of the grab.

The crane travels at 55 f.p.m. on a total of twelve wheels powered by two 10 h.p. motors on diagonal corners. These motors are provided with synchronising connections between rotors and are controlled from a full current drum controller in the driver's cab. The gross weight of each crane, without grab, is 186 tons.

Attention has been paid to the means of anchoring the cranes when not in use, and a rapid action toggle type rail clamp is fitted on each of the two river-side corners of each truck. Land-side clamps are not fitted as it was found impossible to provide an effective clamp and at the same time allow a flush deck for the use of vehicular traffic.

Power supply for the cranes is provided by eight 300 amp. flush deck plug boxes of a special type, designed for easy insertion and removal of the plugs, and arranged so that the plug pins do not take any side pulls from the trailing cables. The plugs' bodies are tubular in form and embody solid pins operating in conjunction with fully floating sockets. The tops of the plugs locate in guide rings in the jetty deck, and are fitted with a type of bead developed by Samuel Williams and Sons Ltd., which restricts the minimum radius through which the plug cable is bent irrespective of the position and pull in the cable. The actual strain from the cable reeling drum is taken by a pair of toggle clamps which are directly linked between the top bead and hinged ears on the jetty deck.

The fact that the driver has complete control over the hoisting motion, coupled with the high speed, enables him to concentrate more on the slewing and luffing motions, the control of which will always be limited by grab swing. On a recent cargo of small coal, cycle times of 21 seconds were maintained when working overside from ship to barge, with drivers who were not skilled in the use of joy-stick controls prior to being trained for these machines. It is also interesting to note that although the new cranes hoist at approximately twice the speed of the older machines, grab damage to ships' holds has been less. The old adage that speed and grab damage are synonymous would, therefore, not appear to be justified if the controllability is good.

Trent Improvement Programme.

A programme of further improvements on the River Trent, estimated to cost £473,000, has been announced by the British Transport Commission. This scheme forms part of the Commission's £5½ million development plan already announced. The work to be undertaken comprises: bank protection and navigation works; the extension of the Cromwell Lock; mechanisation of lock gates and sluices; the provision of dredging and other plant; and of workshops and premises.

The existing Cromwell Lock, some five miles downstream from Newark, although 30-ft. wide and able to accommodate four standard Trent barges (82½-ft. long by 14½-ft. beam) or one large oil tanker, is not sufficiently deep to pass craft through at all tides; and at neap tides craft can pass into the lock only by using a third pair of shallow gates built below the main lock tail to form a "two rise" lock. To eliminate congestion and to overcome the delay of double locking it is now proposed to replace the third pair of tidal gates with deep gates extending up to coping level. This will, in effect, lengthen the lock, enabling it to accommodate eight standard craft or three large oil tankers.

The dredging fleet is to be strengthened and modernised by the provision of three diesel bucket dredgers, replacing three obsolete steam dredgers; two additional bottom tipping hopper boats; ten dredging hoppers to replace eight existing craft; two diesel tugs for the haulage of hopper boats; an excavator for bank works; a self-propelled crane boat; and three diesel cranes for crane boats.

Remedial Measures at Pyrmont, Port of Sydney*

Problem Solved by Cylinder Piling

The Problem.

The continual, gradual but accelerating, subsidence of a portion of Berth No. 21 North, Port of Sydney, known as Nos. 19 to 21 Pyrmont, has been under the observation of the New South Wales Maritime Services Board's engineers for some years. Recently this subsidence became too marked to delay any further the application of remedial measures so as to avoid the possibility of a collapse of unknown extent.

The Berths are founded upon a tipped embankment extending to a depth of about 40-ft. below low water and consisting largely of broken sandstone quarried from the foreshore and cast forward. A much simplified half cross section of the berth structure is reproduced at Fig. 1 and demonstrates the very massive nature of the double - decked structure which has an overall width of 263-ft. between fenders. This width includes wharf aprons 52-ft. wide, two double-decked steel-framed transit sheds 54-ft. wide and twin centre concrete roadways 51-ft. wide. Reference to Fig. 1 emphasises the exceptionally heavy design loads carried by the concrete-encased timber piles and although the live loading has necessarily been considerably reduced in recent years, the extent of the subsidence reached a point several years ago when it became necessary to disconnect at their footings about half of the shed columns at No. 21 Berth and from time to time to jack them to about their original positions, inserting temporary packings under the stanchion bases. Distress in the steel framing at the upper deck level became apparent and eventually the sudden shearing of rivets and bolts became a source of potential danger. The worst drop in level of the lower apron reached about 18-in. and this can be clearly seen at Fig. 2. It was determined from borehole records that the stone embankment was tipped upon stiff clay and sand beds extending about 60-ft. in depth. The clay and sand strata overlie soft rock at about 90 to 100-ft. below low water and it was evident that general settlement of the whole of the sandstone filling with consequent displacement of the upper clay stratum, was taking place.

No. 21 Berth was designed in 1915 and the construction records state that in the placing of the filling, repeated subsidences occurred. These were accompanied by substantial lateral movements of the substratum which in turn necessitated additional dredging alongside. The following comment was made upon these movements at the time:—

"Considerable difficulty was experienced with the outer end of the reclamation owing to the nature of the bottom. Several slips occurred causing subsidence of the wharf and displacement of the shed foundation piles. It was found necessary to suspend operations for several months so as to allow heavy stone filling to reach the solid bottom."

It would appear that it was assumed at the time that the stone fill did eventually reach a solid bottom, and piles about 70-ft. in length driven into the filling to a hard set were adopted as the method of founding the berth superstructure. In carrying out the remedial measures described below, it was found that the stone fill has not in fact yet reached the soft rock stratum.

The Remedy.

Attention was first directed to driving to rock level, long piles of reinforced concrete, but this proposal was rejected owing to the physical difficulty of positioning the piling so as to support the shed and roadway columns, the heavy weight of the piles and the

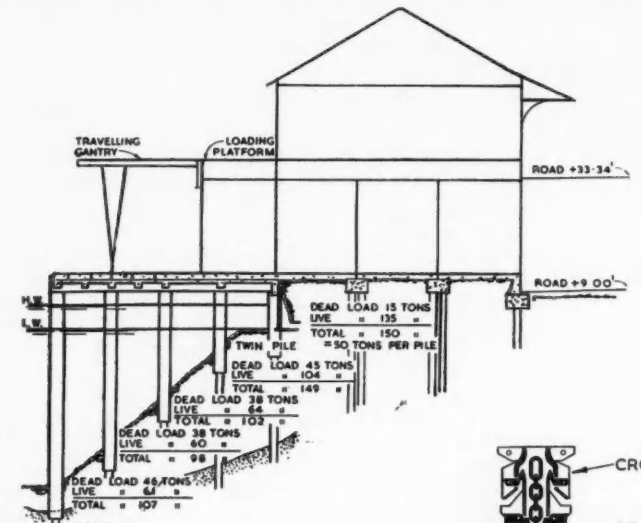


Fig. 1 (above). The original design loadings on piles at Berths Nos. 19-21 Pyrmont. The design live load has been considerably reduced since 1949 in consequence of the subsidences which have occurred.

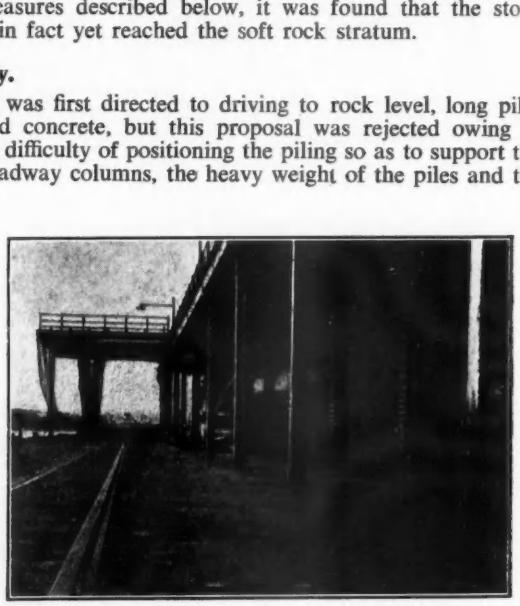


Fig. 2 (right). The wharf apron at No. 21 Pyrmont.

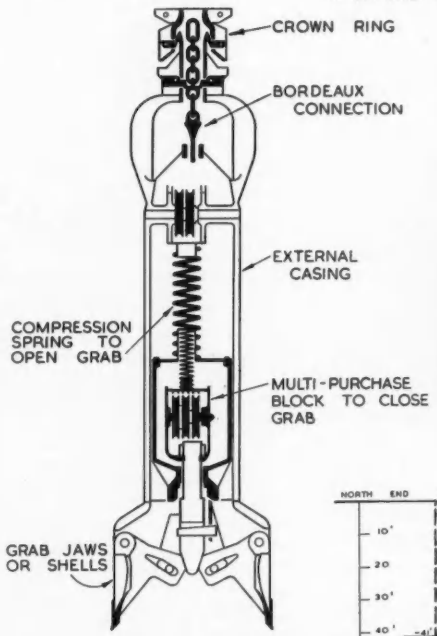


Fig. 3 (centre). Diagrammatic sketch of Hammer Grab showing the principal components.

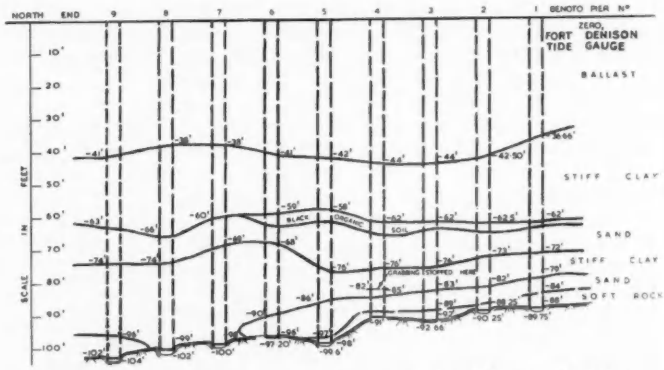


Fig. 4. Geological cross-section and time analysis of sinking of cylinders.

* Extracts from a paper presented before the Sydney Division of the Institution of Engineers, Australia, by Mr. E. J. Griffin, B.Sc.Tech., who is Principal Assistant Engineer, and Mr. J. G. Wallace, Supervising Engineer of the Maritime Services Board of N.S.W

Remedial Measures at Pyrmont—continued

Fig. 5. The improvised Trepanning Tool which has proved most effective in assisting the entry of the cylinders into rock.

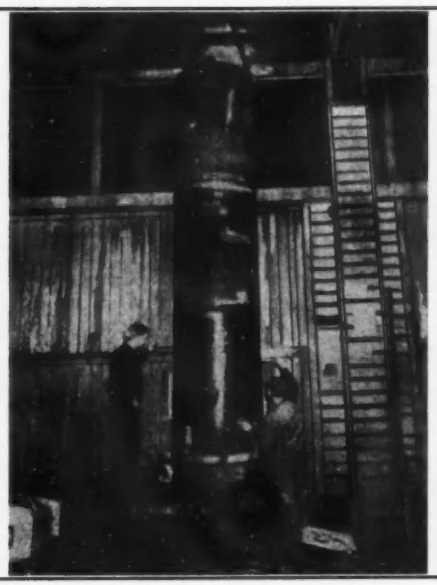


Fig. 6. To ensure that the cylinder remains vertical during sinking, each added length has to be accurately plumbed.

Fig. 7. The Hammer Grab fitted with the large orange peel shell depositing spoil into light rail trucks.

danger of vibration further affecting the stability of the structure. Normal types of cast-in-situ piling are either rendered impracticable or would be very slow and expensive to place due to the presence of the sandstone-filled embankment, and careful consideration was therefore given to the use of large-diameter cylinder foundations carried down to about 100-ft. below low water. This work would have entailed the use of air locks and necessitated the extensive demolition and rebuilding of the wharf transit sheds. This proposal was finally rejected in favour of the use of relatively small diameter cylinders, concrete filled, and sunk by means of a patented hammer-grab developed in France. This grab, the "Benito Hammer Grab," was first used in 1946 at le Havre for the sinking of the foundation piers and concrete caissons through the large masses of war-damage debris at that port, and resulted in the rapid reconstruction and restoration of Le Havre to full efficiency.

The necessary plant, which is capable of sinking steel cylinders of either 31½-in. or 39½-in. diameter to depths of up to 330-ft., was purchased in 1952 at a cost of £A18,500. Its main components comprise a drilling rig, a hammer grab, five grab shells (two of the non-tight variety for dry soils and three tight shells for use in water-bearing strata) and a tubing machine and clamping collar which imparts a reciprocating angular movement to the cylinder during sinking. The steel collar is clamped tightly to the cylinder and a hydraulic ram imparts a slow angular movement at an adjustable rate of between 2 and 4 cycles per minute. Normally the bottom of the cylinder is kept slightly in advance of the excavation and sinks without shock or vibration. A diagrammatic sketch of the hammer grab with its heavy cylindrical shell is shown at Fig. 3. Although not tried out at Sydney, the "super-reinforced" shell attachment is stated to be effective in breaking through good concrete. Penetration into rock of the nine cylinders so far sunk at No. 21 Pyrmont was effected by means of an improvised trepanning tool.

Progress to Date.

The remedial measures presently completed comprise nine 39½-in. diameter cylinders at 12-ft. centres, sunk into rock as shown in Fig. 4, and filled with concrete which is heavily reinforced down to 40-ft. below low water. The nine cylinders are capped by a 4-ft. 3-in. deep by 3-ft. 1-in. wide reinforced concrete beam which is dry-pack grouted into intimate contact with the existing concrete deck. Three progress photographs, which are self-explanatory, are reproduced at Figs. 5, 6 and 7. The site welding of the 20-ft. sections of steel cylinder must be adequate to resist hydrostatic pressure and the torsional drilling stresses, and in this case the procedure for site welds included belling for about ⅛-in., the top of the lower cylinder againt a heavy former, and placing two continuous cover welds in the vee section formed, after carefully plumbing the next 20-ft. section.

It was possible to carry out the work of cylinder sinking after only partial demolition of the upper deck shed (to permit the operation of the drilling rig) and by cutting 4-ft. diameter holes in the lower deck at the cylinder positions. The rate of sinking of the individual cylinders is between 0.66 and 1.29 hours per foot. The net cost of the work described amounts to about £A24,000. This includes a net cost of about £A18 per lineal foot of completed concreted cylinder, which is considered reasonable for this type of work. All plant capital costs are however, excluded from these figures.

Conclusion.

The sinking of cylinder piles through hard obstructions is necessarily slow and expensive. The work reported above took 18 months to complete, and at this rate of progress it is doubtful whether the specialised plant employed has so far justified its capital cost. However, it must be borne in mind that initial experimental work was necessary, that considerable site demolition and preparation work was involved and that better progress could be obtained on a larger job. It is apparent that this method of cylinder sinking may find considerable application in similar conditions elsewhere.

River Law Convention.

The Working Party on River Law, a subsidiary body of the Inland Transport Committee of the United Nations Economic Commission for Europe, held last month its first discussion on a draft convention on the Contract for the Carriage of Goods by Inland Navigation. The purpose of the convention is to formulate international regulations governing the relations between the carrier and the shipper, the sender and the receiver of goods carried between ports by inland navigation. The first session of the Working Party was held 7—15 March and the second will be held next November.

Representatives participated from Austria, Belgium, Czechoslovakia, the Federal Republic of Germany, France, Hungary, Italy, Netherlands, Poland, Sweden, Switzerland, the Union of Soviet Socialist Republics; the Eastern Zone of Germany, the United Kingdom, the United States and Yugoslavia. A number of International organisations were also represented.

Protecting Dock Workers from Grain Dust

Review of I.L.O. Enquiry

By ERIC FORD

Health risks associated with the handling of grain have long been the subject of study and regulation by dock and harbour authorities in the world's large ports and recently the Inland Transport Committee of the International Labour Organisation (ILO) has given considerable attention to this problem. The most recent development has been the publication of a study which summarises present opinion on the subject and contains the results of enquiries in a number of countries including Australia, Belgium, Canada, France, Western Germany, India, Italy, Netherlands, Pakistan, Switzerland and the Union of South Africa.

Everywhere it was reported that dock workers engaged in particular grain-handling operations are liable to contract certain respiratory disorders which are generally agreed to fall under one or other of two main conditions, described respectively as "acute" and "chronic."

Under the "acute" condition, sometimes known as "grain fever," the signs will take various forms and may include an intense irritation of the respiratory passages, catarrh of the nose, a loose cough, difficulty in breathing and a pain in the chest, while sometimes the eyes are affected or general asthma-like symptoms are observed. The "acute" form, however, only occurs during actual exposure to the grain dust and the symptoms cease soon afterwards.

On the other hand, the "chronic" condition, which shows itself in the form of bronchitis, with difficulty in breathing and shortness of breath on exertion, may persist for months, or even years, after exposure to grain dust.

Scientific opinion is not yet agreed on the exact cause of these disorders although they are thought to be probably due to either the presence of mineral dust, the effects of the small sharp spiky hairs from the grain husk, the existence of spores of various moulds and fungi always present in grain dust, the influence of protein fractions in the grain dust to which some people are allergic or the action of the mites which infest grain. Considerable work on all these aspects of the problem has already been done and is continuing in many different countries.

If agreement has not yet been reached upon the actual cause of the different forms of grain disease, it is admitted that dock workers must be protected as far as possible against the effects of prolonged contact with grain dust which vary in seriousness with the type of grain handling equipment in use.

Many of the world's smaller ports still employ manual or mechanical methods which give rise to considerable quantities of dust, through the use of ordinary shovels, loading spouts, mechanical grabs and conveyors. The pneumatic plants employed in most large ports, however, produce only small amounts of dust when well designed and properly operated.

International Views of the Problem.

Whatever the method of operation, however, considerable amounts of dust are always liable to be present during cleaning operations around the equipment and in maintenance work. The report of the Belgian Government, for example, stated that although pneumatic equipment is used at Antwerp to transfer the grain from ships to large silos, the emptying and cleaning of dust extraction chambers produces a certain amount of risk of contact with dust, for which reason workers engaged in this work are issued with protective respirators.

In its section of the report, the National Health and Welfare Department of the Canadian Government emphasised the importance of "good housekeeping" in the prevention of dust hazards, not only as applied to the avoidance of an accumulation of dust but through the use of cleaning methods which do not raise dust to any appreciable extent. Some Canadian authorities have adopted regulations requiring dust-control systems which, while mainly concerned with the prevention of dust explosions, do also contribute towards the elimination of health risks. Respirators are widely used by elevator staffs and stevedores in Canada and dust-collecting systems are in operation at Fort William and Port Arthur, on the Great Lakes, and also in some elevators at the Pacific Coast ports of Vancouver and Prince Rupert.

According to the report of the French Government, only grain from the Near East and North Africa (especially Morocco) is sufficiently dusty to be the cause of pulmonary trouble among dockers. The French Government also considers that when grain has been de-dusted during its passage through a suction unit, the dust should not be restored to the grain after it leaves the equipment.

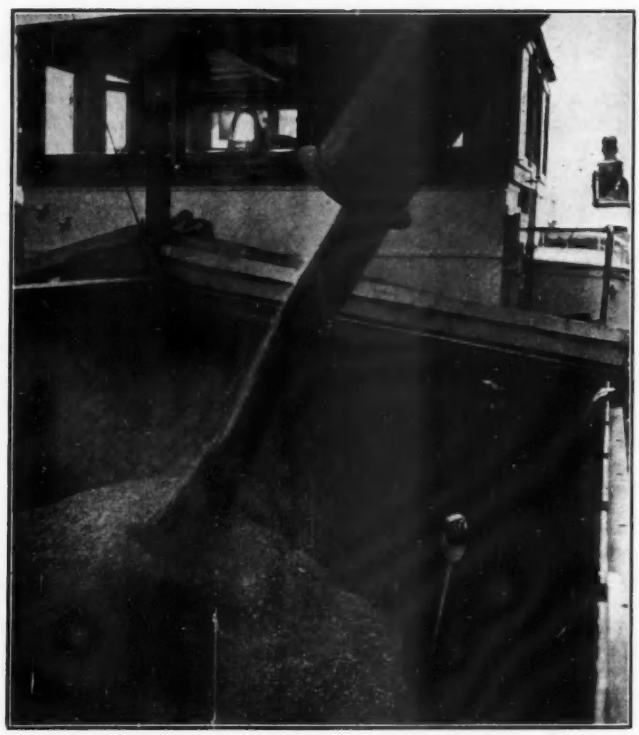
This view is also expressed in the report of the Government of the German Federal Republic (Western Germany) which undertook two exceptionally detailed investigations into health problems associated with grain dust as recently as 1953. These took the form of a scientific analysis of the organic and inorganic components of grain dust and a medical investigation of 39 dockers who were exposed to dust hazards. Of these, 19 were suffering from acute forms of the complaint, such as dry coughs and breathing difficulties which, however, did not last long after leaving work and in any case had disappeared the following day. The other 20 workers complained of more or less persistent symptoms which included coughing, a burning feeling in the chest and a shortness of breath, similar to bronchitis, although there were no signs of bronchial asthma.

To meet the situation revealed by the results of the investigations, the Germany Labour Inspectorate which carried out the tests recommended that all grain should be pre-cleaned when it is first handled at any seaport, that all transit and bagging scales should be enclosed to make them dust-tight, that mechanical dust exhaust equipment for cleaning storerooms and plant premises should always be fitted and that air supply respirators and oxygen breathing apparatus should be provided for personnel in need of them.

Certain recommendations of a medical character were also proposed by the West German Labour Inspectorate. These included a special pre-employment medical examination for all workers likely to come into contact with grain dust and a periodical X-ray examination every two years while this employment lasted.

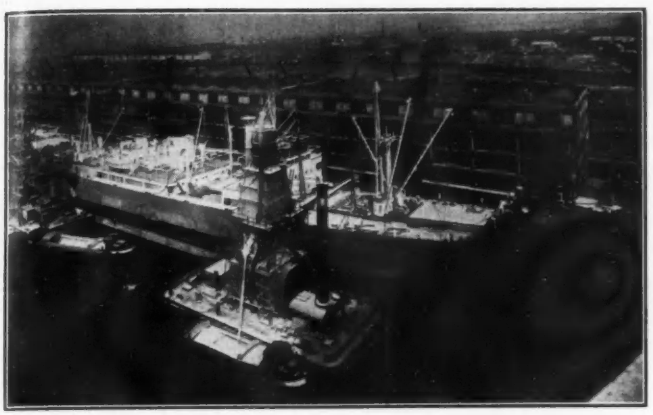
Various port administrations in Italy made recommendations which included the use of a suitable cream to protect the exposed parts of the body and special clothing to fit tightly at the neck, wrists and ankles. The Italian Government, like all large importers of grain, strongly suggested that dust should always be removed from grain while cargoes are being loaded at the port of origin.

On the basis of these reports, the ILO study therefore concludes that the undoubted dust hazards to health could at least be re-



Loading wheat into barge, Rotterdam harbour

Protecting Dock Workers from Grain Dust— continued



Two floating plants transferring grain pneumatically from a sea-going ship to barges.

duced if all loading and unloading were done by dust-tight pneumatic equipment and if respirators were always employed for operations which cannot be made dust proof, such as the cleaning of ships' holds and dust-extraction equipment. In these cases, the danger from dust could certainly be minimised by the use of vacuum equipment and by ensuring that the work in which the dust hazard is present is shared equally among all the personnel of the port so that each individual has only brief spells in an atmosphere of grain dust, alternating with dust-free work elsewhere.

In conclusion, the study declares: " From the evidence available it seems clear that the greatest single contribution to the elimination of hazards to health from handling grain dust would consist in the abandonment of the practice of returning dust and dirt to grain in transit for the purpose of making up weight."

No doubt it will be a considerable time before this principle, as well as others mentioned in the study, are generally accepted by the parties concerned. The ILO is continuing its work on health hazards due to grain dust, and its further activities in this direction will be awaited with interest.

The Problem of our Inland Waterways

Institute of Transport Paper

By W. L. IVES, LL.B.
(Principal Traffic Officer, British Transport Waterways).

In a paper delivered before the Metropolitan Section of the Institute of Transport, on 4th February last, Mr. W. L. Ives, LL.B., M.Inst.T., Principal Traffic Officer, British Transport Waterways, briefly surveyed the early history of British Inland Waterways and continued to explain the state, at the time of Nationalisation, of those waterways now in the hands of the British Transport Commission. Since his address was to an audience who could not be expected to be familiar with this specialised subject, his survey necessarily covered many points which have been emphasised before but their presentation was lucid, unbiased and accurate. The paper concluded with an outline of the present situation and some possible remedies for the problems.

In his introduction, Mr. Ives said that it is probably true to say that there is no more controversial field among the various forms of transport at the present time than the waterways. Some say that they have long ceased to be of any real value and should be filled in and used as roads; others argue that they should be restored and that, as they are the cheapest form of transport, a vast increase in traffic will follow. Further, according to the latter view, if it were not for the obstructive control of the railways, and subsequently the British Transport Commission, the waterways would be developed on a scale comparable with those of certain Continental countries; this tends to ignore the realities of the situation and finds no support within the industry itself, including the independent canal carriers. " Amid this welter of controversy," continued Mr. Ives, " I shall attempt to focus attention on what I conceive to be the real problems of the waterways, and in doing so I must make it clear at the start that some of these problems are not connected with transport, many waterways in process of time having become important sources of water supply for agriculture and industry, and acquired uses for land drainage, pleasure boating and fishing."

Historical Background.

Continuing with the historical background to the problems, the author recollected that the Industrial Revolution could not have occurred as it did except for the " canal era " from 1760 to 1830. He continued, from this point of canal prosperity:—

" The prosperity of the canals was shortlived. The situation was transformed with the invention of the steam engine, and from 1830 onwards their position began rapidly to deteriorate.

" Tolls for the use of the canals were severely cut, and although the owners sought and obtained power to act as carriers, this had little success and to the present day most of the traffic on the canals and inland waterways is carried by the independent carriers or byetraders. Many of the proprietors undertook the construction of railways themselves, and others, as a part of Parliamentary bargains, were able to force the railway promoters to acquire canals. In the event about one-third of the total mileage then existing passed to the control of the railways, and much of the remainder fell into disuse or was formally abandoned.

" Towards the end of the last century it was felt that the railways, under the conditions then prevailing, had secured a virtual monopoly of inland transport, and in 1906 a Royal Commission examined the position of the waterways in very great detail. Their deliberations lasted until 1910, and an elaborate scheme known as ' the Cross,' linking the Midlands with the Thames, Humber, Mersey and the Severn, and capable of taking up to 300 ton craft, was suggested. Their recommendations were, however, not unanimous and the scheme was held up by the 1914-18 war. It was never proceeded with.

The Great War and the 1920 Committee.

" During the war the canals were, rather belatedly, brought under Government control, and some temporary increase in traffic was secured, but afterwards, when canals were returned to their owners, their difficulties were greater than ever before, in view of the rise in the cost of labour and materials, and the emergence of road competition. A Departmental Committee under Chairmanship of Mr. Neville Chamberlain, M.P., in 1920 considered that owing to the further deterioration of the canals and the post-war increase in costs, the 1906 scheme was then impracticable and they advocated the establishment of Public Trusts, each responsible for a particular group and subsidised by the State, and having power to act as carriers as well as toll takers. They also recommended certain limited improvements; one to the River Trent was subsequently carried out, but apart from this no action followed.

Road Competition.

" Road traffic continued to develop and competition from this source, and more especially that between road and rail competition, led to a catastrophic reduction in the rates for certain traditional canal traffics, such as grain, which made it impossible for many of the independent carriers to continue. The effect was felt principally on the narrow canals, which are capable of carrying 25 tons per narrow boat. Rivers and broad waterways, although feeling the effect of this competition, were in a stronger position, and the period of the inter-war years is notable for the carrying out with Government assistance of several major schemes. One of these was the improvement of the Trent up to Nottingham by the Nottingham Corporation, and others were on the Grand Union

The Problem of our Inland Waterways—continued

Canal and the Lee. Of these the Trent and Lee schemes led to a substantial increase in traffic, but the ambitious attempt by the Grand Union Canal Company to improve the through route from London to Birmingham and to build a large fleet of narrow boats was not so successful, owing to the cost being larger than anticipated, and inability to man more than two-thirds of the fleet, due to shortage of skilled boatmen."

Then another Royal Commission in 1930 studied the problem afresh and concluded, rather unambitiously, with this advice:—

"We have already quoted evidence which tends to show that there is no room in this country for the construction of new canals, and we turn, therefore, to the question of the possibility of improvement of the existing waterways. It must be borne in mind that the canals were constructed by a very large number of private companies and that there is a complete lack of standardisation. Although any very elaborate scheme of standardisation would be unduly expensive the possibility of improving short sections which interfere with the working or through routes should be considered."

Even this limited programme of improvement was not implemented (except for the Grand Union improvements which were already in hand) and by 1948 traffic figures were at their lowest level.

The Lessons of History.

Mr. Ives explained that he had referred to history at some length because it is so often misrepresented and he stressed the following points:—

"(1) The extent to which canals had deteriorated, with certain exceptions, mainly the navigable rivers.
(2) The effects of road competition, forcing down rates to uneconomic levels.
(3) The consequent loss of carriers.
(4) The unanimous opinion of independent inquiries that there should be some form of public ownership, with a widely held belief as to the need for some form of financial assistance.
(5) Support by the Royal Commission 1906 (but not unanimous) for a scheme of major improvements to be met out of public funds. Not accepted by the Departmental Committee of 1920 or the Royal Commission of 1930.
(6) Failure of successive Governments to accept most of those recommendations, and also to take any steps to deal with the situation, creating a legacy of neglect to which the British Transport Commission have succeeded."

There was indeed no shortage of problems as far as the waterways were concerned.

Rusholme Board of Survey.

After briefly dealing with the activities of the Commission until 1954, the paper reaches the important point of the establishment of the Rusholme "Board of Survey":—

"Notwithstanding these steps there was a persistent agitation for the greater use of the waterways and this led in 1954 to the appointment of the so-called Board of Survey under the Chairmanship of Lord Rusholme, a member of the Commission, with Sir Rex Hodges, formerly General Manager and Secretary of the Mersey Docks and Harbour Board, and Mr. R. D. Brown, formerly Chief Engineer of the Manchester Ship Canal. The Board's remit was to consider whether the maximum economic advantage was being derived from the Commission's canal system, and what steps should be taken in regard to inland waterways which could no longer be put to economic use.

"You will be aware that there has been much criticism regarding the composition of the Board of Survey. It was first of all that the Board was not impartial. This is manifestly not so: Lord Rusholme, as a Member of the Commission, owes no particular allegiance to any particular branch of the transport system, and there are two independent members whose appointment, as already stated, was approved by the Minister. It has also been said that the members had no knowledge of the subject. This again is untrue because Sir Rex Hodges, as Chief Officer of the Mersey Docks and Harbour Board, had an intimate knowledge of the canals in the North West, and Mr. R. D. Brown, as already stated, had been Chief Engineer of the Manchester Ship Canal, which is the largest single canal undertaking in this country. Of their independence and competence therefore, there can be no doubt.

"The broad conclusions reached by the Board of Survey were as follows:—

(1) The waterways on the whole have been a declining industry since the advent of the railways over 100 years ago and that the process had been accelerated with the development of road transport.
(2) In spite of recommendations of Royal Commissions and other bodies, little was done to remedy the situation until the passing of the Transport Act, 1947, which placed the waterways under the control of the Commission. It was not surprising that during the comparatively short period the waterways had been vested in the Commission a solution had not been found. Faced with these problems the Docks and Inland Waterways Executive. and later the Board of Management had accomplished much which should be of lasting value, and the main bodies of carriers all expressed their appreciation of what had been done. The Board of Survey found many of the criticisms which had been made of the present administration were unjustified.
(3) Statistics submitted show that traffic on the estuarial and canalised rivers having connections with the ports, had increased, while that on most of the other waterways had declined. The main traffic routes, though in a better condition than they were before their transfer to the Commission, still require further and very heavy expenditure. Of the remainder many of the waterways are either disused or little used, and several, though not statutorily closed or abandoned, are no longer navigable and could not be made so except at heavy and unremunerative expenditure. Others which have been closed or abandoned are still maintainable by the Commission in order to meet such needs as water supply or land drainage.
(4) Two-thirds of the system incur a heavy loss and there is an overall deficit which has varied during the three years (1951-1953) from £573,367 to £102,060. No contribution to interest or other central charges has been made.
(5) There are substantial losses on certain of the Commission's carrying services and many private carriers, particularly on the narrow canals, have gone out of business and have not yet been replaced. There is, in addition, an acute shortage of labour in some branches of the carrying trade.

"In the light of this serious position, the Board of Survey, after recommending the establishment within the Commission of a separate organisation to deal with the waterways under the control of a General Manager who would be able to give them his undivided attention, stated that the next step must be to concentrate on those activities which were of real value as part of the transport system, and to relieve the Commission of the remainder which were placing a heavy burden on the waterways administration and finances. With this object in view the Board of Survey divided the waterways into three categories—Group I: those to be developed (total mileage 336); Group II: those to be retained (total mileage 994); and Group III: those having insufficient commercial prospects to justify their retention for navigation (total mileage 771).

"The recommendations of the Board of Survey have been violently attacked and there has been a disposition to concentrate on the proposals which related to Group III—waterways having insufficient commercial prospects to justify retention for navigation—to the exclusion of everything else, though not by the organised bodies of the Canal Carriers and such undertakings as the National Coal Board and the Central Electricity Authority who have the greatest interest in the use of waterways.

"The future of these Group III Waterways is a national problem wholly unconnected with transport and the Land Drainage Legislation Sub-Committee of the Central Advisory Water Committee in 1951 came to the conclusion that River Boards were best fitted from the point of view of both functions and constitution to take them over. There is much to be said for the adoption of such a course as the River Boards are already responsible for the control

The Problem of our Inland Waterways—continued

of land drainage (which includes agricultural water supply), pollution prevention and regulation of fishing on these waterways and it seems perfectly logical that once a waterway has ceased to be used for transport purposes it should be regarded as any other watercourse and come under the control of the River Board, whose membership includes representatives of the very bodies who are vitally interested in these particular matters. The Board of Survey, therefore, supported the recommendation of the Land Drainage Legislation Sub-Committee of the Central Advisory Water Committee and emphasised the need for speedy Government action. The Government alone—and here I speak of several departments, not only the Ministry of Transport but also Agriculture and Fisheries, Local Government and Planning, Health and probably the Board of Trade in respect of industrial water supplies—can deal with this matter.

"These waterways involve the Commission in a loss of about £200,000 per annum, which should not be borne by the transport user. To restore them to commercial navigation would cost several million pounds, without the possibility of any appreciable return.

"The Board of Survey proposed that the Caledonian and Crinan Canals in Scotland should be transferred to the Secretary of State for Scotland.

The Bowes Committee.

"The Report of the Board of Survey was submitted to the Ministry of Transport who took the view that the widespread interest aroused by the report indicated that there was a need for a further inquiry on a broader basis which would embrace the entire system of inland waterways in this country, including those not in the Commission's ownership, and the wide variety of interests concerned in their future. In February, 1956, he accordingly appointed a committee for the purpose of carrying out such an inquiry under the Chairmanship of Mr. Leslie Bowes, Managing Director of the Pacific Steam Navigation Company, and that Committee is still in session.

Action Taken by the Commission to Implement the Rusholme Report.

"I am pleased to say that the appointment of this further Committee has not held up action on the Board of Survey's report.

"The first recommendation —that relating to the establishment of a separate waterways organisation under the control of a General Manager, was brought into operation on the 1st January, 1955, and Sir Reginald Kerr, formerly Divisional Manager of the Midland Division of British Road Services, was appointed to the position. Sir Reginald has brought a fresh mind to bear on the problems of the waterways, and the effects of his drive and initiative are everywhere apparent.

Possible Remedies.

The author concluded by explaining possible remedies, although some lines of positive action are not available until the Bowes Committee has concluded its work. His conclusions were as follows:—

"I have, in the short time at my disposal, endeavoured to indicate to you some of the main problems with which we are faced and how we are endeavouring to deal with them. There is no simple solution. It has been said that every waterway can be made to pay if it is properly managed (which is nonsense and is in variance with demands for a subsidy); that canals provide the cheapest form of transport (well described in the words of a recent writer, 'as if a heavily locked narrow canal shared some secret of cheapness with the Atlantic Ocean because they had the magical watery element in common'); that you have only to restore the derelict canals and the traffic will follow (which ignores the changes which have taken place in the economic life of the country since these canals were built and also the fact that this has been attempted unsuccessfully in a number of cases); that the waterways should be developed to the standard of those on the European mainland (which overlooks the fact that Europe is a Continent and this country is an island with good sea communications, and that the physical conditions in the Low Countries are particularly suitable for canal construction); that you have only got to advertise for traffic (which in fact is highly selective and competitive), and so forth.

"Other suggestions have been made that the waterways should be transferred back to private ownership or to an independent waterways authority. As to the first, every Royal Commission or inquiry which investigated the position of the waterways prior to 1947 recommended some form of public ownership. The second takes no account of the question of finance because if derelict navigations are to be restored principally for pleasure traffic, someone has to pay and pay very heavily.

"I can speak," continued Mr. Ives, "with some experience of this matter as former Chief Officer of a public body which had all the powers which would be given to the proposed independent waterways authority, i.e. navigation, water supply, fisheries and land drainage, and, indeed, was similar in character to the Thames Conservancy, which is usually quoted as the prototype. With all the avenues available from these sources and the unique geographical advantages and a dense commercial traffic, we just about paid our way. To expect the proposed independent authority to bear the heavy losses and to undertake the restoration of the disused waterways (which apparently is its main object) is out of the question.

"None of these proposals face up to the real problem of the waterways, which is simply the difficulty of an older form of transport competing with the newer ones which may be cheaper, more expeditious or more flexible in operation. That we are able to hold our own and expand in certain fields gives us a measure of justifiable confidence, but we should be deluding ourselves and others if we failed to recognise that the utility for transport purposes of certain waterways has passed away as a result of the changes in the economic life of the country which have taken place since canals were originally constructed 150 years ago. If we concentrate on those fields of activity in which we are able to offer a cheap, reliable and satisfactory service to the customer then we shall continue to make an increasing contribution to the transport system of the country. These are:—

(a) traffic imported and for shipment in the ports connected with the inland waterway system, particularly in those instances where overside delivery from ship to barge or vice versa takes place;
(b) traffic which can be carried from point to point in barge-loads;
(c) traffic conveyed to or from waterside premises;
(d) petroleum and liquids in bulk;
(e) traffic requiring bulk movement and storage in the canal-side warehouses;
(f) trunk haul to river or canal waterheads with subsequent delivery by road.

"To sum up, our objective is to develop the Group I waterways to the maximum pitch of efficiency, to provide for existing and potential demands, and to see that Group II are properly maintained and to increase the traffic upon them. But it would not be justifiable to continue to spend large sums of the transport users' money in uneconomic expenditure in restoring facilities on canals which are not required for traffic purposes. If the Government decide that on broad grounds of public policy uneconomic canals should be retained or improved, then there is no alternative but some form of financial assistance out of public funds. It is, however, doubtful whether the making of waterways toll free would provide a sufficient inducement for carriers to set up in business on certain of the narrow canals. It would, in all probability, be necessary to go further and to provide the finance at low rates of interest to enable them to build new craft.

"If, on the other hand, it is considered that the facilities provided by these disused or insufficiently used waterways are not required, then they should be transferred to the public bodies who desire their retention for purposes other than transport, whether it be for water supply, land drainage, amenities and so forth.

"The solution of these and other problems must await the findings of the Bowes Committee and Government action thereon. What is vitally important to all concerned is that a clear and definite policy should be evolved, whether of expansion or contraction, and a full acceptance of the implications. There has been too much uncertainty for too long."

With the last sentence, all who are actively and seriously interested will emphatically agree. G. L. H. B.

Proposed Inner Harbour for Port Kembla

Development of Tom Thumb Lagoon

(Specially Contributed)

Introduction.

PORT KEMBLA is a harbour, which in little over fifty years, has grown from an open roadstead, used solely for the shipment of coal, to one of the principal industrial ports in Australia. To meet the rapidly increasing demands of shipping, part of the adjoining Tom Thumb Lagoon is at present being dredged to form an inner harbour to provide at least 12 berths and capable of expansion to at least 46 berths.

The management of the project is being undertaken by the Department of Public Works, New South Wales, but the construction of the inner harbour, consisting mostly of dredging, will be carried out by contract.

History of the Port.

Over the period from 1854 to 1897 a number of colleries were established to work the large coal deposits on the south coast of New South Wales. These were served by several small open roadstead jetties from which the coal was shipped to Sydney.

The coastline generally is exposed. Southerly to easterly winds generate ocean waves with estimated heights up to 30 feet but, at Port Kembla, some measure of natural protection is provided by a rocky headland to the south.

The coal trade continued to increase and it became necessary to provide further protection for the jetties. In 1896 designs were prepared for a harbour at Port Kembla and in 1898 Parliamentary approval was given to the construction of the eastern breakwater. This commenced in 1900 and in 1912 it was decided to construct the northern breakwater. Construction of both breakwaters, enclosing an area of 344 acres, has proceeded progressively since then and is still incomplete, although mostly carried out during the period up to 1930. The extent of the harbour is shown in Figs. 1 and 2.

Whilst the breakwaters were being constructed, additional port facilities were provided to meet the expanding industrial development of the area. A conveyor belt coal loading jetty was constructed and, with the establishment of a steel works nearby in 1928, the trans-shipment of iron ore and steel products began to play a significant part in the trade of the port and resulted in the construction of a jetty for this purpose. The small jetties were replaced by larger jetties more suitable for the needs of the heavy industries.

With the passage of the years, the coal trade through the port has declined and has now almost disappeared. It has, to some extent, been replaced by the shipment of coke, but the predominant trade is now that associated with the industries surrounding the port, especially the steel works. The export of coal and coke, which was originally the sole trade, now constitutes only 10 per cent. of the total trade of the port.

The need for an Inner Harbour.

Early in the history of Port Kembla it was recognised that it could not be regarded as an all-weather harbour which could adequately meet the increasing demands for shipping and, as early as 1916, a proposal was prepared for the construction of an inner harbour in Tom Thumb Lagoon. This was designed at the time to enable a prospective expansion in the coal trade to be met, but the scheme lapsed, although the boundaries were retained in any subsequent sales of land in the area.

In 1950 it became evident that further consideration would have to be given to an inner harbour to provide for the growing trade of the port. The outer harbour did not provide adequate shelter during gales or heavy seas and additional berths could not reasonably be provided beyond those at No. 6 jetty now under construction. In addition, the foreshore was being utilised in such a manner as to make it impossible to provide adequate rail and road access as well as the areas required at the base of jetties for assembly of cargoes, buildings and the parking of vehicles, as can be seen from Figs. 2 and 3.

An Inter-departmental Committee representing the Department of Public Works, the Maritime Services Board and the Railways Department held meetings at Port Kembla and in Sydney and, in 1951, recommended the construction of an inner harbour in Tom Thumb Lagoon. During its deliberation the Committee obtained information regarding prospective increases in trade through the port during the following ten years. A graph of the trade of the port was prepared and extended on the basis of 75 per cent. of the anticipated increase taking place in fifteen years instead of ten years. This gave an anticipated trade of 3,500,000 tons in 1962-63. The actual growth of trade has been such, however, that this tonnage was exceeded in 1954-55. Fig. 4 gives details of the total annual trade of the port over the period 1936-37 to 1955-56. It will be noted

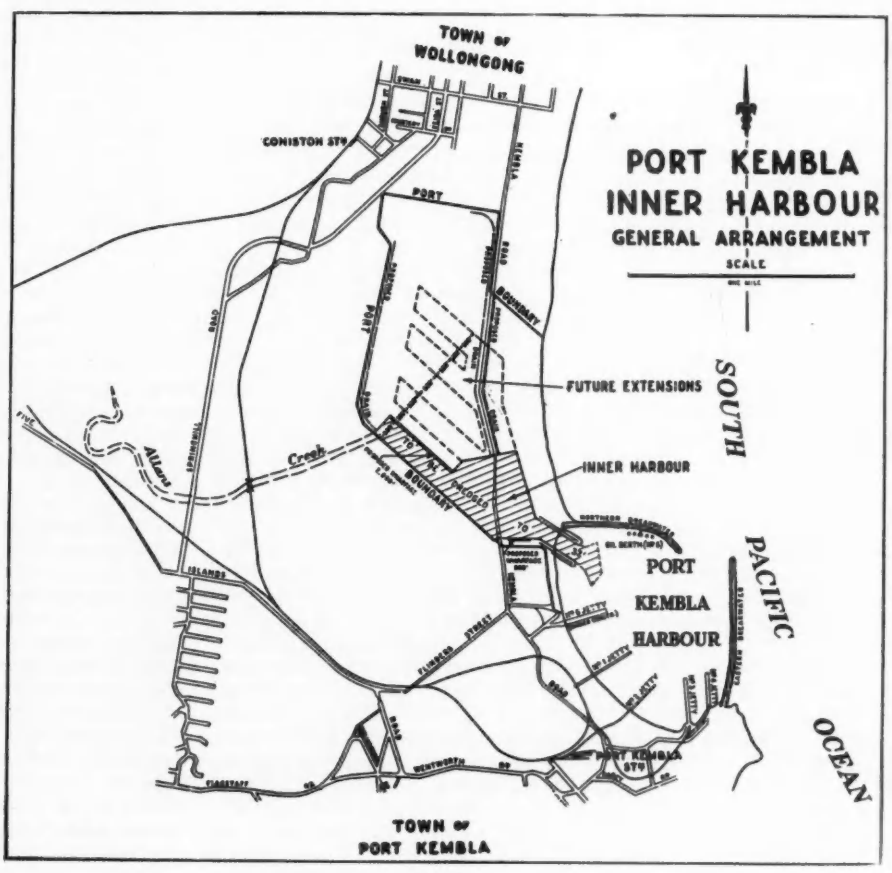


Fig. 1.

Proposed Inner Harbour for Port Kembla—continued

Fig. 2. General view of Port Kembla Harbour. The white lines indicate the proposed inner harbour entrance.

that there has been a marked increase in trade since 1949-50 and there is good reason to expect that this will continue for some years to come, especially as a second steel works is now under construction on the southern frontage of the proposed inner harbour.

In 1936-37 approximately 825 vessels handled the one and a quarter million tons of trade whilst in 1953-54, 506 vessels handled three and a quarter million tons. The increase in the average nett tonnage of the vessels from 1,500 to 3,000 during this period would not account for the reduction in the number of vessels; it is apparent that the cargo imported and exported per trip was a much higher proportion of the vessels' capacity.

The question of the probable size of future cargo vessels is constantly being discussed and opinions being reviewed. At one time it appeared as if a berth depth of 28-ft. would meet the requirements of most vessels trading, or likely to trade, to Port Kembla. However, in order to make full provision for probable increase in size of cargo vessels, it has been decided to provide a depth of 32-ft. I.S.L.W. wherever possible at Port Kembla. This will meet the requirements of the larger vessels now proposed to be used by the steel works. The requirements for the tankers now trading to New South Wales ports is 35-ft. and this can readily be provided along the northern breakwater of the outer harbour.

Inner Harbour as Planned and Authorised for Construction.

The layout shown in Fig. 1 provides for ultimate expansion in stages to at least forty-six berths. Various layouts were considered, but the proposal adopted involved the maximum excavation per berth and provided for stage expansion.

The width of piers as shown on the plan is very tentative and will only be decided when it is necessary to construct wharfage on the second side of each pier. Type of cargo to be handled, necessity or otherwise for cargo sheds and method of transport will be the major determining factors. The main point is that there is provision for the design to be amended to meet requirements in each phase of the development of the inner harbour.

The part indicated by the full lines in Fig. 1 has been authorised by Parliament and is the only part that will be constructed at this stage. The steel works which owns most of the land to the south-west of the site of the inner harbour has been granted the right to construct wharfage along the south-western boundary of the inner harbour. Authority has also been granted the Department of Public Works to construct government wharfage on the southern side and on the north-eastern boundary where indicated. These will provide for a total of more than 5,500-ft. of berthage and it will be possible to add additional berths without extending the dredged area. The area of part authorised for construction is approximately 100 acres.

No special provision has been made in the inner harbour for docking or ship repairing. These facilities are seldom required at other than a terminal port, but if the trade expands to the extent that, firstly, repair facilities and, later, dockings are desirable, it will not be a difficult matter to amend the tentative plan to provide accordingly.

The inner harbour will have no shelter from winds between the south-east and north-east and it is proposed, at the appropriate time, to ask the Forestry Commission of the State if they can recommend a species of trees which would grow on the ocean front and provide some shelter from onshore winds.

It is proposed to fence the port area around the inner harbour and all inwards and outwards traffic would be controlled by gatekeepers. With the elimination of non-port traffic, road and rail traffic in the port can operate more freely and, in addition, pilfering, especially of articles which cannot be carried on the person, can be reduced.

A number of special problems have risen with regard to the design of the harbour. These include the provision of drainage for both stormwater and industrial runoff. Special precautions are to be taken to ensure that silt deposited in the inner harbour is reduced to a minimum and that local flooding does not occur. The disposal of trade wastes and the discharge of cooling water into the inner harbour from adjacent industries have also brought their problems.

Oil company depots are located generally on the southern side of the inner harbour to

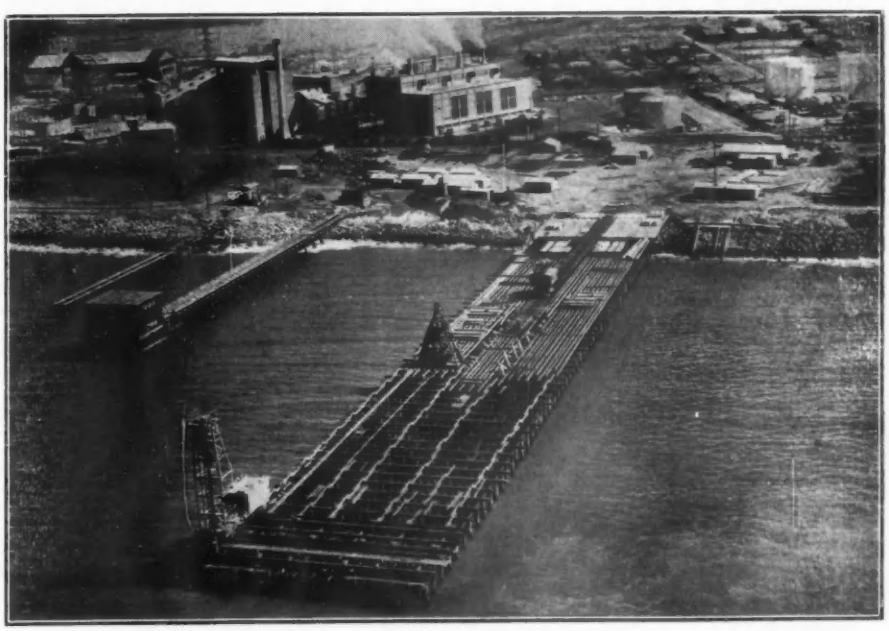


Fig. 3. No. 6 Jetty with the steel pile frame in L.H. foreground, the timber rake frame and the electric locomotive crane.

Proposed Inner Harbour for Port Kembla—continued

the west of the base of No. 6 jetty and pipelines run from these depots to the inflammable liquids berth on the northern breakwater. These pipelines cross the site of the proposed entrance to the inner harbour and this has created another problem. Provision has been made in future expansion of the port area for additional oil depots to be located north of the inner harbour.

Proposed Method of Construction.

Methods of constructing the inner harbour have been given very full consideration. Bores taken indicate that sand, silt and clay exist to depths of at least 32-ft. below I.S.L.W. over the whole of the inner harbour excepting along the southern foreshore where rock is encountered to a limted extent. Construction in the dry involved diversion of all drainage northerly and this was quite a problem. In addition, it appeared from many of the bores that considerable expense would be involved in laying and maintaining tracks for the earthmoving equipment transporting spoil to the disposal area. Another important factor was that the inner harbour could not, by this means, be put into use until such time as the excavation for the whole of the harbour had been completed. Construction by dredging was decided upon as it had the advantage of eliminating most of the problems of excavation in the dry and also it will allow the inner harbour to be brought into use progressively as dredging proceeds.

Construction of the inner harbour was authorised by Act of Parliament which received Royal Assent on 29th November, 1955, and preliminary work commenced by the Department of Public Works in January, 1956. Work has been concentrated at the entrance in the erection of a temporary bridge to maintain access to the northern breakwater and carry the pipelines, the removal of large stone from two walls in the approach to the northern breakwater, the placing of the stone thereby recovered in the entrance training walls and the excavation of a pilot channel to permit a dredge to be floated into the inner harbour.

Whilst dredging is proceeding in the inner harbour the remainder of the stone in the walls across the entrance will be removed and used in the training walls. Additional stone may be obtained from the outer harbour foreshores north of No. 6 jetty in such a manner as to leave a flatter slope and thereby provide some measure of a spending beach. Any further stone required will need to be quarried and transported to the site.

Fig. 5. Model experiments in progress at the Hydraulic Laboratory at Manly Vale.

At the same time part of the entrance channel is to be excavated to form a trench across the entrance in which the oil and other pipelines are to be placed. On completion of the transfer of the pipelines to their final position in this trench, the temporary bridge will be removed and excavation of the entrance channel can then proceed to completion. Before the temporary bridge is removed, access to the northern breakwater is to be provided from the northern side of the inner harbour across the existing entrance to Tom Thumb Lagoon.

The dredging and other works required to provide access to the two downstream berths along the south-western foreshores are to be completed by the end of March, 1960. It is expected that by this date the steel works will have completed the construction of its wharfage along these berths so that they will then be immediately put into use.

The circumferential shores of the inner harbour will be ballasted on a slope of 1 vertical on 1.5 horizontal in places where wharfage is to be erected in the near future and, elsewhere, left with a general slope of 1 vertical on 4 horizontal.

The material removed by dredging is to be pumped ashore to reclaim the remainder of the port area, much of which is now occupied by Tom Thumb Lagoon. The height of the reclamation will be approximately 14-ft. above I.S.L.W. which will be the deck level of wharves to be constructed by the Department of Public Works. Reclamation banks will be erected around the area to be reclaimed. On both sides of Kembla Road the banks will be placed some distance from the road pavement in order to provide two wide and shallow drainage channels which will take care of all drainage now entering the lagoon from the north. It will be seen from the proposed final development of the inner harbour, shown in Fig. 1, that by locating the main drainage channels adjacent to Kembla Road they will not interfere with the progressive development of the inner harbour.

Road access to the wharfage on the southern foreshore will be provided from Kembla Road past No. 6 jetty and along the foreshore of the outer harbour. This will be constructed in the early stages of dredging as it will be required for constructional purposes. Access to the inner harbour from the north will be along Kembla Road. Rail access to the area has been authorised but will not be constructed until such time as future development necessitates this being done. In collaboration with the Department of Railways and the Department of Main Roads provision has been made, however, in the planning of the general develop-

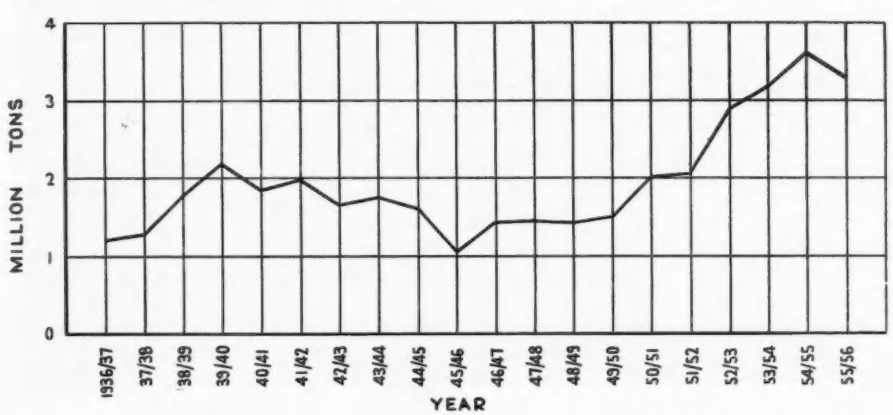


Fig. 4. Graph showing details of the total annual trade over the period 1936-37 to 1955-56.

Proposed Inner Harbour for Port Kembla—continued

ment of the district for adequate rail and road services to be readily provided.

Approximately 5,000,000 cubic yards of spoil is to be removed to form the inner harbour and some of this will be done by the steel works in reclaiming adjoining land and in the construction of its wharfage. Tenders were invited early this year for dredging the remainder of the spoil, estimated at over 4,000,000 cubic yards, the construction of the entrance training walls and other works incidental thereto.

Model Experiments.

Wind and wave action often produces undesirable conditions in the existing harbour and, with a view to taking steps to improve conditions, model experiments have been in progress for a number of years at the Department's Hydraulic Laboratory at Manly Vale shown in Fig. 5. These show that improvement in conditions can be expected to follow extensions of the two breakwaters, especially the northern breakwater, and the flattening of the western foreshore of the harbour to form a spending beach. The extent to which the two breakwaters will finally be extended has not yet been determined but, in the meantime, investigations are proceeding.

Experiments were also carried out on the model of the proposed inner harbour. During these experiments it was found that short period waves would not interfere with shipping in the inner harbour. Waves with a period of 80 to 90 seconds, however, caused oscillations in the inner harbour which had a marked effect on shipping moored at the centre of the steel works frontage. Up to this stage wharves were reproduced with a solid vertical face. The use of wharves supported on piles gave a reduction in wave action of approximately 25 per cent. and, for that reason, it will be necessary to use piled structures for all wharfage. Other modifications, including the location of a spending beach at the north-western end of the harbour and relocation of the northern boundary, indicate a total reduction of wave action by up to 75 per cent. and will improve conditions to such an extent that it is not expected that cargo trans-shipment will need to be interrupted on account of wave action.

Conclusion.

The inner harbour is being constructed at this stage to the extent required to meet foreseeable trade expansion. It will be capable of extensive enlargement and, although no final plans have been prepared for the full development of the inner harbour, it will be seen that steps have been taken to provide for whatever class of trade might use the port at any time. The large area available and the proposed stage development provide all the elasticity necessary for amendment of schemes for expansion. In addition, the port can be developed to handle any type of trade and berthing conditions should be such as will enable trans-shipment of cargo to continue under any weather conditions.

Problem of Port Labour

I.L.O. Stresses Need for Improved Methods

The problem of dock labour is never far out of the minds of people responsible for port work or, indeed, those connected with it. It is interesting, therefore, that at the plenary session of the Inland Transport Committee of the International Labour Organisation held in Hamburg last month, the attitude of port workers and port employers to the needs of the industry was discussed by Mr. T. O'Leary, national secretary of the docks section of the Transport and General Workers' Union on the one side and by Mr. Morris Gifford, of the National Association of Port Employers of the United Kingdom, on the other.

During the discussion of the I.L.O. Report on "Methods of improving organisation of work and outputs in ports," Mr. T. O'Leary praised the frank approach that the report made to the difficulties encountered by both sides of the industry in the attempt to improve the turn-round of shipping. He said that, in spite of the huge sums spent by some port authorities, many ships were still being worked under the restricted conditions of 50 years ago. He mentioned ship design and mechanisation as factors in the solution. There was a need, he said, to design ships having regard for the men whose job it was to work the cargoes. Where mechanisation would be beneficial, there should be complete co-ordination between both sides. He was certain that the men would respond to co-operative action and an equitable sharing of the benefits reaped. He was forced to regard much of the competition between independent employers and labour as stupid. He urged that dock undertakings should make more use of their powers in regulating facilities and resources of the ports they controlled.

Mr. Gifford's speech was another outstanding one. He stressed the different conditions existing between ports in the United Kingdom and also between each of these ports and ports elsewhere. Legislation beneficial to one might handicap another; thus settlement of difficulties at port level might give the best results. He would not minimise the importance of the decasualisation of labour in the port industry, though British port employers would continue to criticise the structure of the scheme of which they were a compulsory part. This gave joint control of the supply of labour but it would be a mistake to impose the same system on the ports of another country. National characteristics and customs, he said, were more important than national uniformity of practice. An important thing to bear in mind was that improvement in the status of the dock worker, welcomed by all, brought increased responsibilities. The unofficial strike in defiance of these responsibilities was the greatest deterrent to quick turn-round.

The speaker went on to make some other important observations: (1) Inter-port competition increases efficiency and should not be discouraged; (2) Neither labour nor employers should go too far into those matters which are the business of the other side. Employers realised this, though many aspects of union maangement were of direct interest to those concerned with improvement in turn-round; (3) Little good could come from individual complaints or from quoting particular instances. Shipowners were unlikely to repeat mistakes which had led to losses in running their ships; (4) Modernisation of ports and their equipment was a prime responsibility of dock undertaking. Capital required was considerable and not always forthcoming; (5) While no one would charge labour with responsibility for all working delays he was conscious of the fact that joint consultations could be made the means of frustrating the introduction of new machinery; (6) The powers enjoyed by port authorities varied from that of the undertaking which had little part in the work of the port to that which was responsible for day-to-day work. No one system was perfect; (7) Joint consultation and discussion should be activated by a desire to be helpful. Faults existed on both sides but labour should not wait for the employers to introduce perfection before starting to do their part.

Increased productivity, he continued, does not benefit only the two sides of the industry. It was an asset to the community at large and the committee's report rightly emphasised the interdependence of docks' costs and the national cost of living. Mistrust must, by every means, be removed but this could never be achieved by the employers paying out more and more money. Employers were human. They, too, required occasional incentives and these labour could provide. Mr. Gifford concluded that the time had come for genuine co-operative efforts which would mark an improvement in dockland productivity.

During the session many other speakers paid tribute to the comprehensive nature of the committee's work. The thorough examination made of such matters as the organisation of dock work, men and machines, inter-port competition and port working co-ordination made possible full and frank discussion between both sides of the industry. The interest taken in the Conference is shown by the fact that more than 200 delegates from 28 nations attended the meetings.

Resolutions Adopted.

Among the resolutions adopted at the conclusion of the meetings were the following:

"It is desirable that a concentrated effort be made to introduce practicable methods of improving organisation of work and output in ports with a view to speeding up the turn-round of ships. A quicker turn-round of ships can make a substantial contribution

Problem of Port Labour—continued

to raising general economic efficiency. This increased productivity can and should be achieved through the use of improved methods rather than by excessive effort. Such improvements are expected to be reflected in better social standards, in which dock workers should have their fair share."

Annexed to the resolution is a series of suggestions as to the methods which would lead to improvement in output. The suggestions deal with the following points: labour-management relations, organisation of work, the introduction of new equipment, port organisation.

After stating that "sound labour-management relations based on active co-operation and mutual trust are an essential element in any programme designed to improve the organisation of work and output in ports," the resolution suggests that certain steps should be taken:

(1) Schemes for the regularisation of employment of dock workers, where they do not already exist, should be developed;
(2) The competent authorities or employers, or both, should take all practicable steps to ensure that new methods of improving organisation of work or the introduction of new equipment do not lead to sudden or arbitrary dismissals;
(3) There should be appropriate machinery involving consultation with employers' and workers' organisation at the port level and, if desired, at the national level;
(4) Procedures for the prompt settlement of grievances and disputes and, in particular, those based on rates of pay or the strength of gangs for particular cargoes and circumstances, are an essential part of a good system of industrial relation;
(5) There should be efficient systems of communication between all concerned in order to inform the docker on all matters relating to his conditions of employment.

The Committee's suggestion concerned the allocation of manpower, the availability of dockers, periods of work, overtime, unproductive time, work study techniques, payment by results, training, safety and welfare. Central hiring arrangements with the establishment of call stands were recommended. Call times should be reasonably arranged, with the double objective of minimising delay to shipping and avoiding unnecessary attendance of dock workers.

The application of work study techniques to port work, the Committee noted, holds the prospect of material assistance in determining methods of increasing efficiency. Various suggestions are made for the effective introduction of schemes of payment by results.

"It is desirable," states the Committee, "to accept new types of mechanical equipment, whether they are for use on board ship or on the quayside, and new methods of work, when they are efficient, economic and safe. It is also desirable that they should contribute to easing the work of the dock worker and to speeding up the turn-round of ships."

To increase the efficiency of the port industry in relation to matters other than labour, the Committee asked that special attention be paid to co-ordination problems, the adjustment of timetables and methods of administrative authorities, and various specific administrative steps.

Ore Handling at Mo. i Rana, Norway

Recent Improvements to Port's Facilities

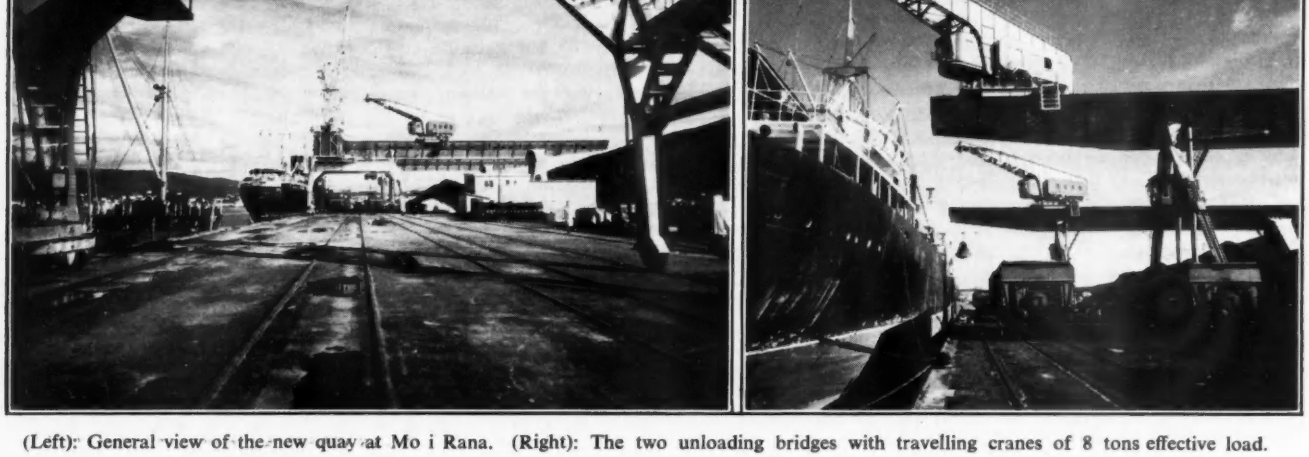
By OLAV BYE

Situated a few miles south of the Arctic Circle, the small port of Mo i Rana, in North Norway, has recently been brought to the fore by the erection there in 1955 of a new iron and steel plant by A/S. Norsk Jernverk. Indicative of the sudden growth of its importance is the fact that, whereas at the end of the Second World War the town had a population of only 1,700, this figure has now grown to over 8,000 at the present time.

In the first stages, handling facilities at the port were only required for such imports as cement, building materials and machinery, but now the plant is in operation, berthing space is required for export shipments. The Mo i Rana Steelworks is already producing at the rate of 180,000 tons of rolled products per year and, with later extensions, it is estimated that the works will eventually have a production capacity of 500,000 tons of steel. To appreciate the importance of Mo i Rana to the country's economy, it should be noted that Norway's consumption of rolled steel products amounts to about 500,000 tons a year.

At its present stage of development, the plant is producing heavy and light sections, bars, wire rods and strip as well as sheet bars.

Mo i Rana is situated at the end of the Ranafjord and its harbour is well sheltered by mountains on either side. The port is navigable throughout the year. Before the war, there were only two small quays in existence, neither of which is now in use. The most frequent callers at the port were coastal vessels and local freighters which had no particular need of efficient quays and other such modern harbour facilities. In 1943, however, during the building of the North Norway railway, the nationally owned railway company constructed a concrete quay at the port. This is 128 metres in length and has a depth alongside sufficient to accommodate vessels of drafts up to 24-ft. So far no cranes have been installed at the quay and loading and discharging is carried out by the ships' own gear. However, plans are under consideration



(Left): General view of the new quay at Mo i Rana. (Right): The two unloading bridges with travelling cranes of 8 tons effective load.

Ore Handling at Mo i Rana, Norway—continued

to extend the quay to an ultimate length of 208 metres with a depth of 30-ft. all along the quay. It is equipped with a shed having 640 sq. metres of floor space.

The new quay, owned by the Mo i Rana Steelworks, has been constructed close to the works and is connected to them by an electric railway. It is able to handle about 600,000 tons of raw materials per year. These consist mainly of concentrated iron ore and coke and some 200,000 tons of mill products.

The quay is constructed of reinforced concrete and is 250 metres in length, 16 metres in width and has a depth alongside of 26-ft. The main part, 100 metres long is designed as a pier, while the remainder is a normal quay with a back fill of soil pumped from the bottom outside the quay. The area thus gained, 1,500 sq. metres, is now used as a storage yard for coke.

The dimensions adopted for the quay allowed for an effective useful load of 3,000 kg./q. metres, loads for four railway tracks, two bridge cranes, one derrick crane of 100 tons capacity and two 6 ton portal cranes for the loading of finished products. The two large unloading bridges are equipped with travelling cranes of 8 tons capacity for handling bulk cargoes. Special wagons are employed on the electric railway to handle the shipments. There are weigh bridges for in and out going traffic.

To date, no regular bunkering station has been set up at the harbour but bunkering can be supplied to vessels of up to 2,000 tons deadweight. Fresh water is available at both quays. The port is equipped with mechanical workshops for minor repairs but there are no shipyards or slipways. Pilotage in the harbour is compulsory and plans are in hand for a pilotage station to be established at Mo i Rana for the assistance of coastal traffic. The Company is responsible for the clearance of all vessels calling at the Works' quay.

There has naturally been a significant increase in the number of ships calling at Mo i Rana since the steelworks commenced production. In 1955 a total of 502 vessels of 284,000 gross tons visited the port and in the first half of 1956 these figures were 377 vessels with a gross tonnage of 234,000 tons.

Manufacturers' Announcements

Portable Megaphone

A new portable megaphone for use in speaking across distances or against background noises was announced recently. Called the "Transhailer," the instrument uses transistors instead of valves. Power is supplied by small torch batteries which can

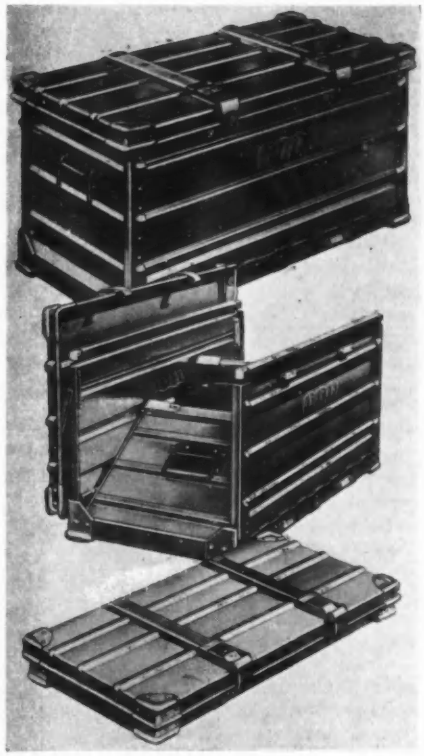
be expected to last several months in normal use. The megaphone is light and robust; it weighs only 5 lbs. and has good speech quality.

Manufactured by PYE Telecommunications Ltd. of Cambridge, the instrument has particular application for marine and dockside work.

New Collapsible Container to be made in Northern Ireland

The Minister of Commerce for Northern Ireland, Lord Glentoran, announced recently that a Government-built factory near Belfast is to be occupied by Light Alloy Construction Ltd., a subsidiary of Summerson Holdings Ltd., of Darlington, County Durham. The firm will manufacture a new type of aluminium freight container which will be sold or hired out to manufacturers and carriers. Limited production will start in mid-summer of this year and a separate Company, Tracon Ltd., has been formed to handle sales and the hiring of containers.

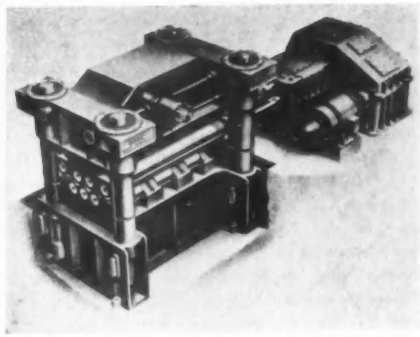
The Tracon containers, which are of up to 16½ cubic feet capacity are made of toughened aluminium alloy with hardened steel corners, and are so constructed that they can be used repeatedly over the years. Packaging costs are therefore reduced. When these containers are emptied the sides can be collapsed and secured for the return journey. They are only half the weight of comparable wooden cases and five collapsed containers takes up the same cubic capacity



as a full one. The containers can be secured against pilfering; insurance rates can therefore be lower. Airtight and waterproof plastic bags are available for packing products which easily deteriorate, or which need protection from damp and insects. Containers can also be perforated to allow air to circulate through trays of fruit or around livestock. They can be stacked by fork trucks without pallets.

New 15" Heavy Plate Leveller

Recent developments in the Middle East have strengthened the need for larger ocean-going oil tankers, and to meet this need and the demand generally for heavier plates in ship construction, The Head, Wrightson Machine Co. Ltd. of Middlesbrough, have designed a new leveller for ship's plates. This Roller Leveller is capable of handling



ship's plates up to a maximum of 2-in. thick by 12-ft. wide to the standards demanded, particularly where welded construction is used. The first unit of this type weighing approximately 200 tons is now being built for Messrs. Swan Hunter & Wigham Richardson. The machine is of robust construction measuring 35-ft. in length, 13-ft. in width with a height of 18-ft., of which 6-ft. will be below floor level.

The various features incorporated in this leveller are based upon experience gained from the design and manufacture of a wide range of roller levellers and in particular those machines already operating in various overseas shipyards. Since the average length of ship's plates to be handled is in the region of 25-ft., the output from such a machine can be greatly increased by reducing the number of levelling passes required.

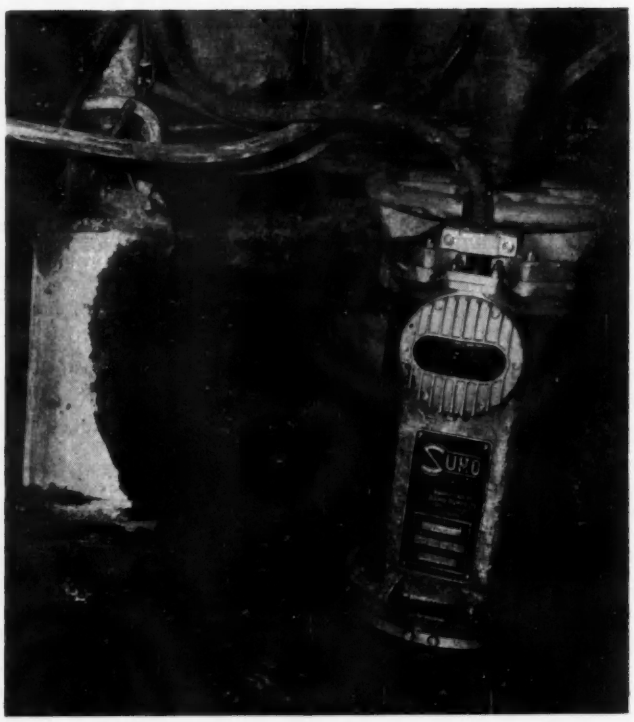
To achieve this and to extend the range of thickness of plates which can be handled on one machine, the diameter of the levelling rolls has been reduced as much as possible and by using three banks of backing rolls across the face width of the working rolls it has been possible to use a roll diameter of 15-in. The backing rolls are carried in special heavy duty roller bearings.

Manufacturers' Announcements—continued

Submersible Drainage Pump

Sumo Pumps Ltd. recently announced that they are producing, after successful field tests of prototypes, a new submersible drainage pump capable of handling a high proportion of solids.

The unit weighs 238 lbs., the main body and ends of the pump being of aluminium alloy, and it will deal with any water containing solids which can pass through its ⅜-in. square stainless steel strainer mesh. The pump can be left running indefinitely, completely or partly submerged, on full bore or "on snore." The single stage bronze impellor and the wearing ring surrounding its inlet are the only major components of the pump subject to wear when pumping abrasive particles. Suspension is effected by the rising main pipe of the pump or, to allow the use of flexible hose, by ropes. If necessary it can stand on its own base. Should excessive mud or sludge be drawn into the pump, or for cleaning purposes, provision is made in the pump inlet for a hose connection from an external water supply to form a jet into the pump.



A production model and a prototype pump working "on site."

By directing the water from the impellor round a large area of the outer walls of the motor housing efficient cooling of the stator has been achieved and the pump can be run for long periods without overheating. However, if the water supply ceases completely and the pump is left running dry, or if it jams accidentally, an automatically resetting thermostat operates to give additional protection. The pump is supplied with either of two impellors for working at various depths. Working at 60-ft. with the No. 2 impellor the pump will pass 6,000 gallons per hour.

A special starter has been developed which is adequately overloaded to safeguard the pump at the specific voltage and frequency. If required it can be supplied with a portable stand. A.C. electric supply must be available to operate the pump.

Palletless Handling

A system of palletless handling of interest to those concerned with the movement of sacked goods was demonstrated recently.

Known as the "Accopak" system it involves merely the use of a number of paper slings in conjunction with a fork truck ancillary attachment. A sheet of Kraft paper suspended between two paper tubes, 3-in. in diameter, forms the sling which is used in place of a normal pallet. The sling is lifted by circular tines, 2-in. thick and 12-in. in length, which are inserted into the tubes. The tines are manufactured from high grade manganese-molybdenum alloy steel and are fitted to the "Hydrum" loading clamp instead of the normal clamping arms.

To facilitate the entry of the tines into the tubes, one tine is 2-in. longer than the other. This enables it to be located in one tube first, the second being adjustable laterally by means of an independent control on the clamp. Independent horizontal movement of either arm gives a total combined range of movement between the tines from a minimum of 17-in. to a maximum of 60-in.

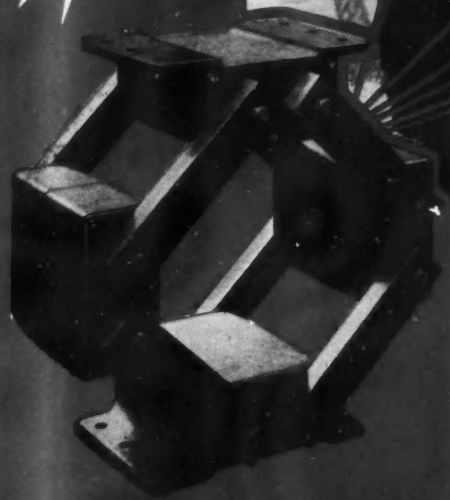
Using this system an increase in storage capacity of approximately 25 per cent. is possible as the 6-in. formerly taken up by each pallet can now be utilised for an extra layer of sacks.

The equipment was recently demonstrated by I.T.D. (Stacatruc) Ltd., in collaboration with R. H. Corbett & Co. Ltd.

Order for "Enterprise" Locomotives

An order valued at over £200,000 was recently placed with Messrs. Hudswell, Clarke & Co. Ltd., of Leeds, for eight mainline Diesel Hydraulic Locomotives for the Sierra Leone Railway. Powered by a Paxman Diesel engine of the "Hi-dyne" (Constant Horsepower) type fitted with a Vulcan-Sinclair "Dual-Fluidrive" transmission unit, this class of locomotive has been developed during the last four years under the name "Enterprise." The prototype locomotive has undergone extensive and successful trials.

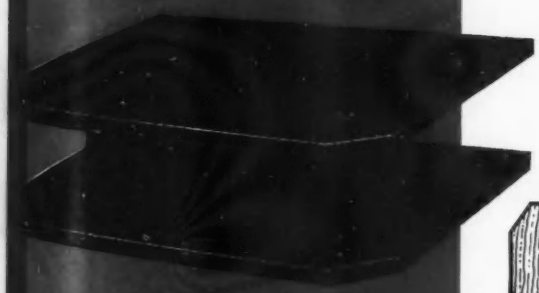
IMPACT ABSORBED



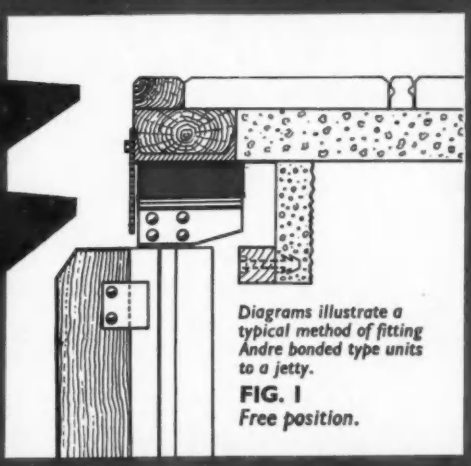
The Andre-Neidhart Unit.

Andre rubber Fender Pile Units are designed to absorb very heavy impact loads such as are encountered by the fenders on jetties and wharves. The Andre-Neidhart Fender Pile Unit is shown above in an installation on The Regent Oil Company's Coaster Jetty, Canvey Island.

Below is shown an alternative Fender Pile Unit of the bonded type.



Bonded Type Unit.



Diagrams illustrate a typical method of fitting Andre bonded type units to a jetty.

FIG. 1
Free position.

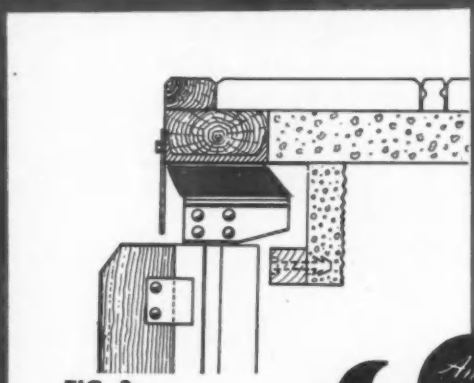
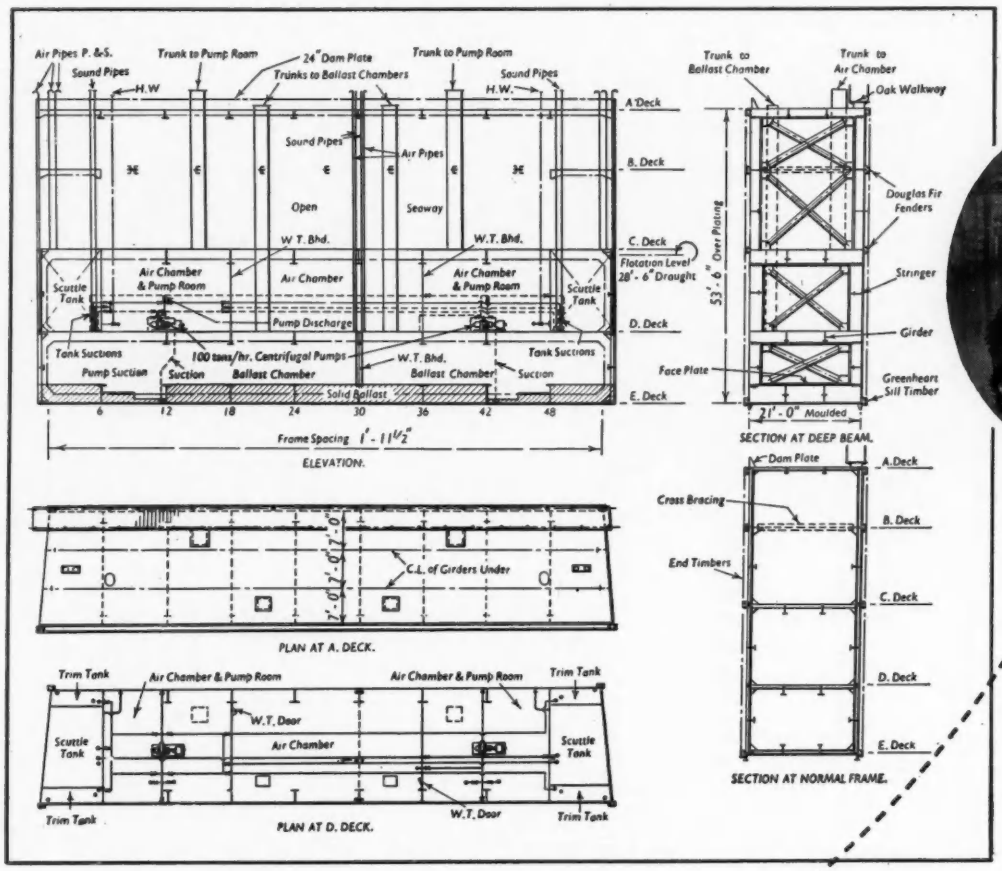


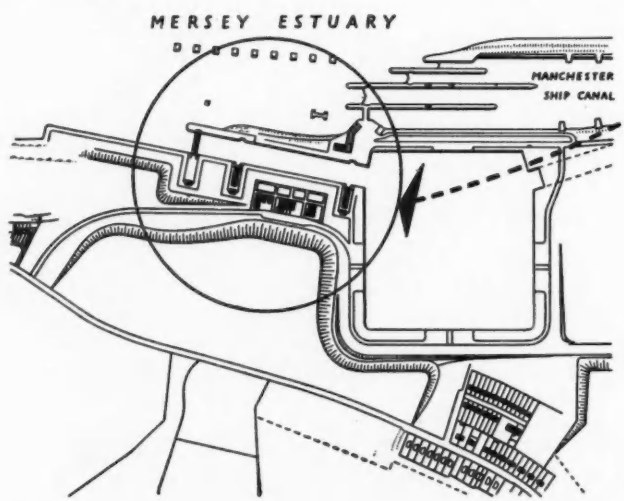
FIG. 2
Under load.

ANDRE RUBBER

All-welded sliding CAISSONS at the Queen Elizabeth II Dock



Uprighting Caisson Gate at entrance wall at the Manchester Ship Canal Company's Oil Dock at Eastham.



Three Vickers-Armstrongs sliding caissons form an essential part of the Manchester Ship Canal Company's Queen Elizabeth II Dock at Eastham on the Mersey Estuary. They are part of an entrance lock into the main dock. Their all-welded steel construction displaces some 1700 tons. Each is 106 feet long, 23 feet wide and 60 feet deep. There is a total water pressure on a caisson of approximately 5000 tons when water is up to the top deck on one side and it is dry on the other. The Caisson operating machinery was also manufactured by Vickers-Armstrongs, including the 'VSG' variable speed hydraulic gears.

Vickers-Armstrongs were pioneers in the adoption of the "all-welded" technique of caisson construction. Further information is given in the publication "Dock Gates, Caissons and Pumps," a copy of which will be sent on request.

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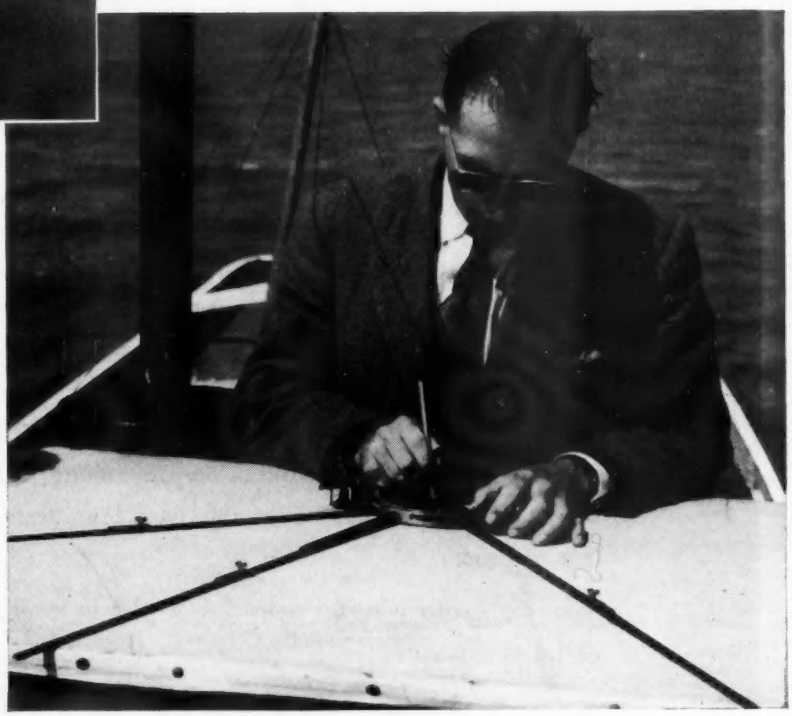
GREAT OUSE flood protection scheme

WASH PROTECTIVE WORKS



Extensive Hydrographic Surveys of the Great Ouse outlet into the Wash were carried out by Kelvin Hughes for the Great Ouse River Board in 1953, 1954 and 1955.

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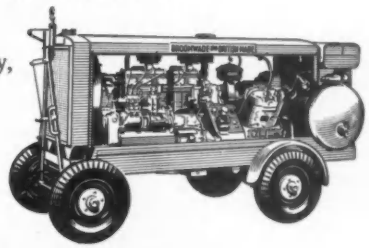

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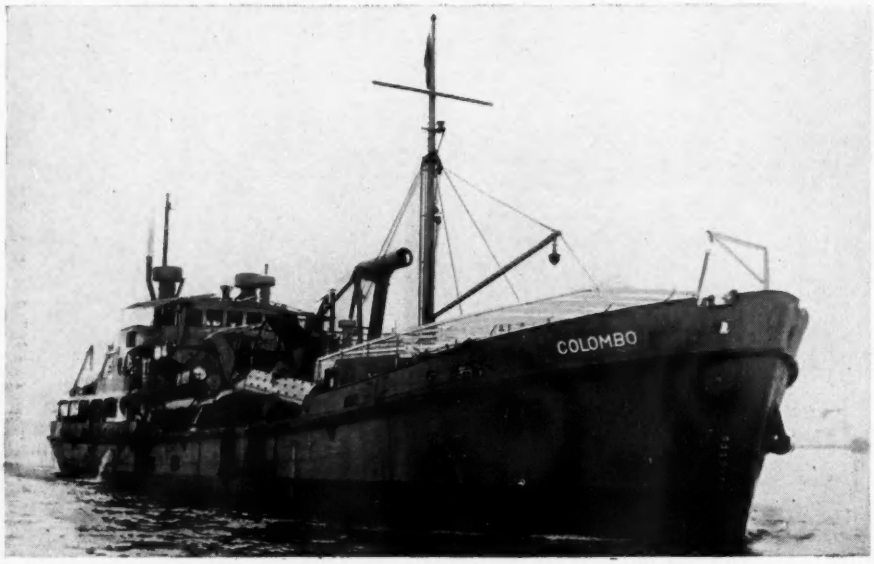
I.H.C. HOLLAND NEWS ITEMS

A BI-MONTHLY BULLETIN ON DEVELOPMENTS IN DREDGING

SUCTION HOPPER DREDGER FOR COLOMBO



The diesel-electric suction hopper dredger "Colombo", built for a Belgian contractor and since put to work at Ceylon made the voyage to Colombo under her own power. She is a twin-screw suction hopper dredger, also equipped as a cutter suction dredger.

Whilst at anchor the "Colombo" sucks by means of a flexible suction tube to starboard and delivers the spoil either into the hopper, or into a barge lying alongside to port. A rigid suction tube has also been supplied. When moored to the shore the dredger can suck from its hopper and discharge through a shore pipeline.

The dredger can also discharge the spoil through bottom doors while navigating.

When operating as a cutter suction dredger through a suction tube with ladder in the after part of the ship, the vessel is moved forward by means of spuds and a spud carriage fitted in a well in the forward part of the ship, and is swung from port to starboard, and vice-versa, by means of two side winches installed aft. In this case the spoil can be delivered either to the shore through a floating pipeline, or into the hopper through the loading pipes.

The main dimensions of the vessel, which has been built in accordance with the rules and under the special survey of Bureau Veritas, are as follows: length 223 ft, breadth 38 ft and depth 18 ft 3 ins. Power is supplied by diesel motors, whilst transmission and distribution are electrical.

The twin propellers are direct driven by diesel motors, and twin rudders are fitted, one behind each propeller. The rudders are operated through electro-hydraulic steering gear from the wheelhouse, or by emergency gear fitted aft in case of electrical failure.

The dredge pump is installed in a separate pump room, together with the pipeline connections, the stone box of the cutter suction tube, connections of the side suction tube, the suction pipes from the hopper and the connections of the delivery pipelines to the deck.

The windlass, suction tube winches, central winch and side winches are all electrically driven.

The hopper capacity is 820 cu.yds. (625 m^3). When working as a normal suction dredger the dredging depth is 50 ft (15 m), and when working as a cutter suction dredger the dredging depth is 42 ft (13 m).

The bottom doors are opened and closed by means of hydraulically operated rams. The crew's accommodation, arranged forward, is sufficient to enable the dredger to operate on a 24 hour basis. The "Colombo" is a multi-purpose suction dredger with a wide range of possibilities. Information on this and the many other craft built by I.H.C. Holland will gladly by supplied upon request.

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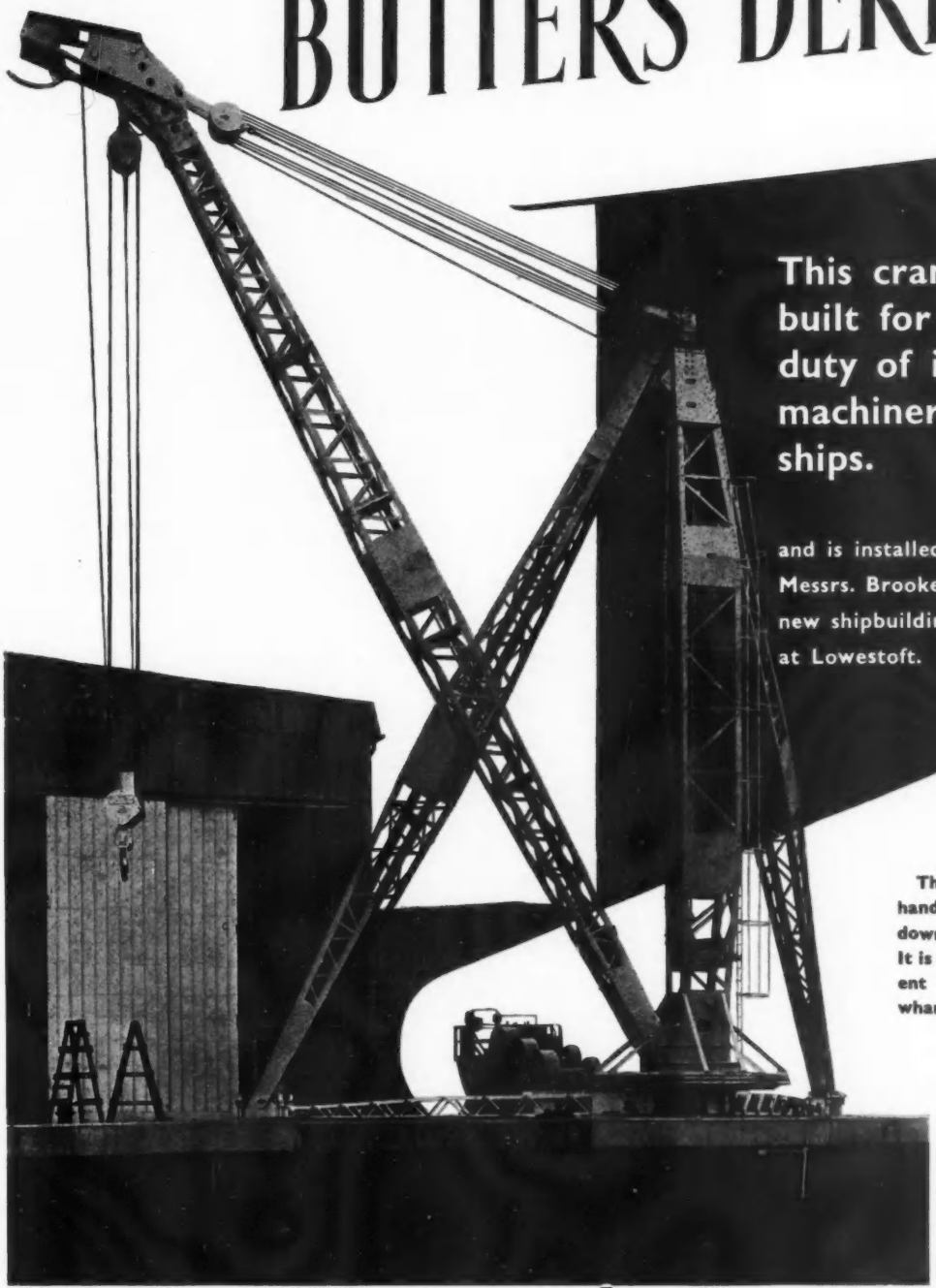

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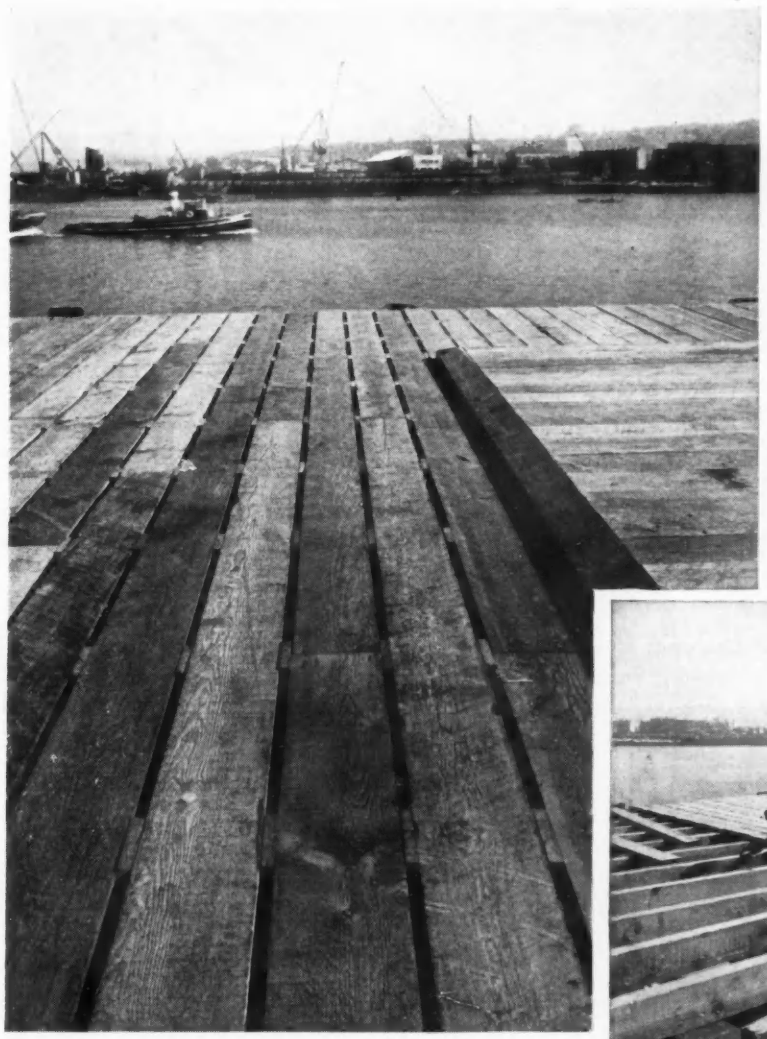

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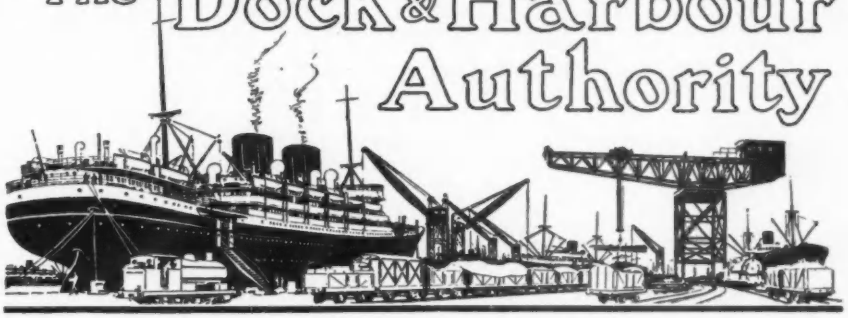

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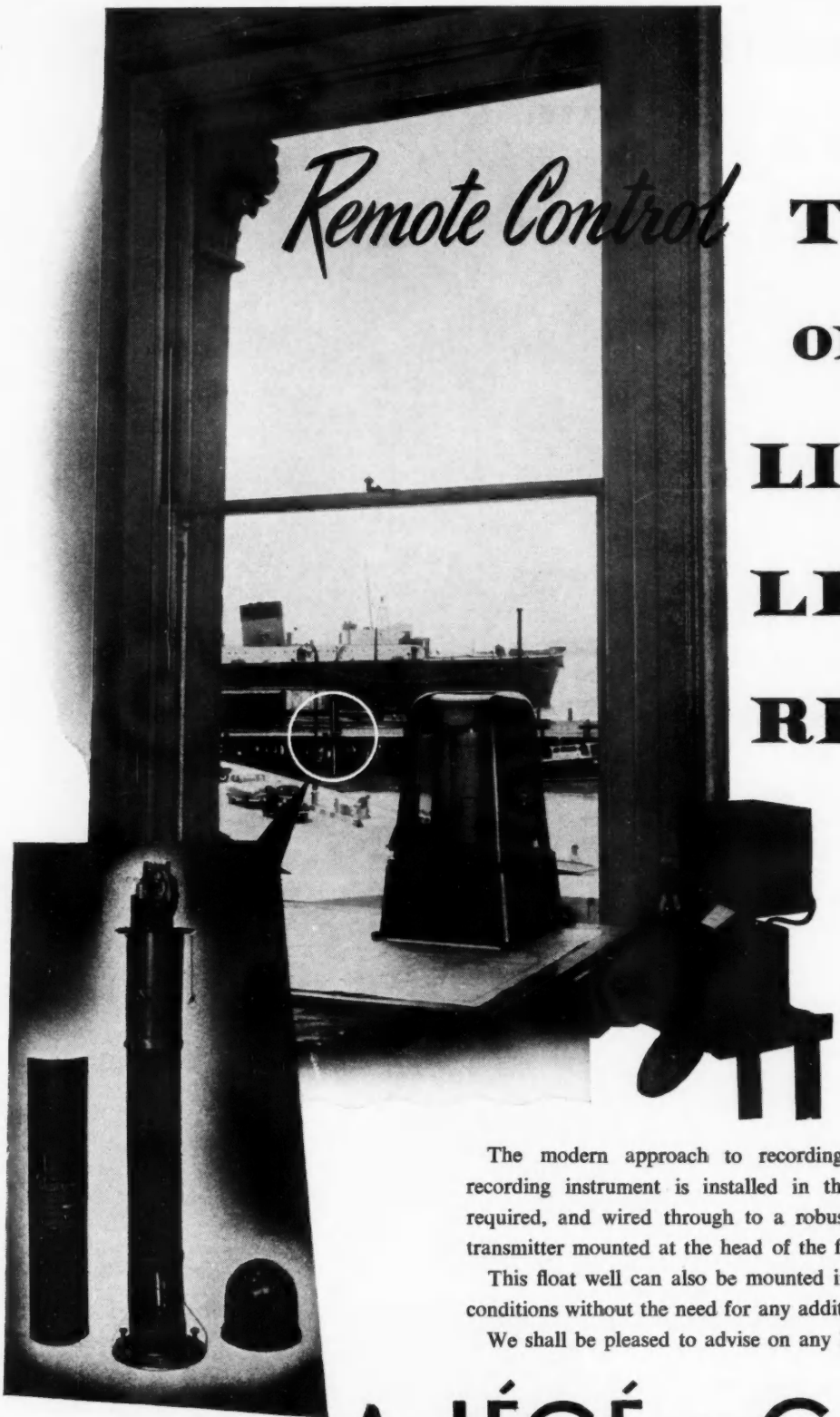

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WIN PE, Chairman.

PORT OF RANGOON

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